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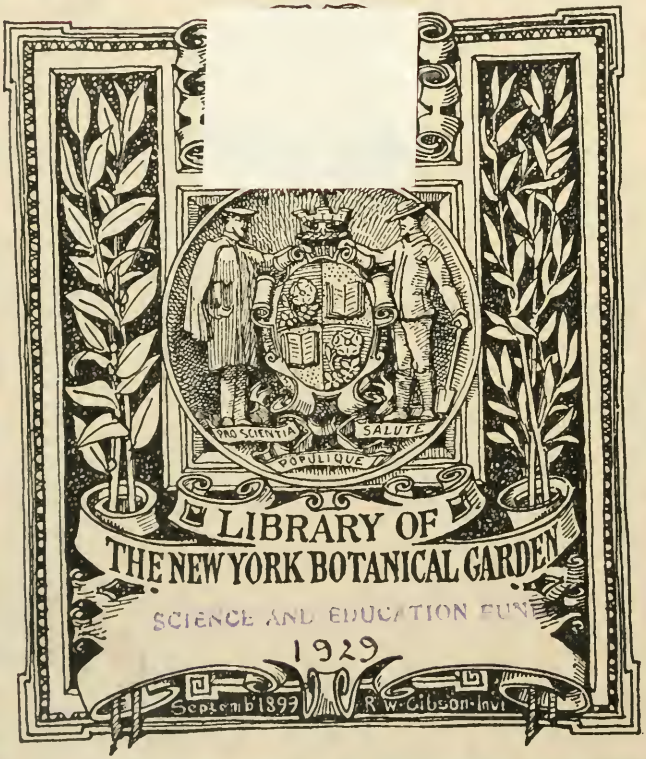
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THE

JOURNAL OF FORESTRY

AND ESTATES MANAGEMENT.

A MONTHLY ILLUSTRATED MAGAZINE DEVOTED TO THE SCIENCE AND PRACTICE OF ARBORICULTURE AND THE GENERAL MANAGEMENT OF ESTATES.

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THE

JOURNAL OF FORESTRY

AND ESTATES MANAGEMENT.

Our Introductory Note.

THE JOURNAL OF FORESTRY AND ESTATES MANAGEMENT may fairly be called upon to justify its appearance among the magazines of the month by some statement of its aims and purposes, its plans and prospects, as well as the field and place it is intended to occupy. It might be almost a sufficient reason to assign, that every great interest in the community has seen and felt the necessity and advantage of having an organ for the promotion of the improvement, and the maintenance of the welfare of that speciality with which it is concerned, and of those who are engaged in it. In such a medium of communication, all the information which can be gathered together can be concentrated, exhibited at one view, and utilized in the best way. In it, all questions affecting the interest which it guards can be considered and discussed by and among those who are most intimate with its facts, principles, and details, and who have most to gain or lose by the manner in which they are settled. Through it, also, common action may be taken, advisedly, on all matters affecting the progress and prosperity of the parties connected with that special interest; while, in addition to all these separate benefits, the existence of a special organ conduces to the creation of an *esprit de corps*, and tends to bring into unity the several members of the constituency to which it appeals, and give them co-operative power. These general considerations may, we say, be regarded as offering a fair preliminary justification of the advent into the crowded fields of journalism of a periodical devoted to the promotion of Forestry, as it is now

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acknowledged to be, not only a practical art, a specific science, an æsthetic joy, and an economic interest; but also intended to be a medium of inter-communication between those who are engaged in any way in the interests and industries which relate to timber products—whether at home, in the colonies, or in foreign lands. We seek to draw a widely dispersed and locally far separated constituency into a union for intellectual and practical culture, mutual improvement, social intercourse, and personal elevation and progress; to give it cohesiveness and power, and to bring all its various members into closer relationship in spirit as well as in interest.

It cannot be said by any one that the interest in whose favour we offer to originate a centre is one of slight significance. The best authorities inform us that the value of the forest produce of Great Britain alone exceeds £3,000,000 sterling per annum. That represents a large total of capital and industry, as well as a wide area of country occupied; and it indicates that there is a material interest involved, quite sufficient to call for some combination of effort to secure its full development, better progress, and continuous welfare. In this all are concerned,—the proprietors of the extensive acreage laid out in wood and forest, the promoters of public parks and pleasure-grounds, the chiefs of those industrial arts in which timber is employed, the gentlemen of taste and position to whom arboriculture presents itself as an æsthetic pursuit, and all those who as factors, managers, assistants, labourers, &c., are engaged in carrying out practically the desires of those who have interest in forestal lands, either as investments, as property, as ornaments in landscapes, as objects of scientific research, or as industrial pursuits. When, however, we extend our thoughts and reflect on India and the Colonies as sources of interest in regard to wood produce, the sense of the necessity of a *Journal of Forestry* receives enhancement, and our wonder is excited that such an organ has not long ago been established in this country for the organization and centralization of forestal interests. It is true, we know, that the want of one has been felt keenly and widely, although various obstacles have hitherto prevented the establishment of it; but, that hesitancy has been exercised heretofore on inadequate grounds will, we trust, be proved by the support given to the present endeavour to enfranchise Forestry in the Republic of Letters.

It may not be out of place to attempt a brief outline of the matter which may wisely and usefully form some portion of the contents of such a journal as shall bring Forestry into the foreground as a science, an art, an economic department, and a source of social and personal delight.

The following, among other possible sections, may be named:—

Descriptive Forestry.—Giving sketches of the best-known forest woodlands of our times, their extent, their variety, their products, their management, and the localities in which they are situated.

Historic Forestry.—Notices of the ancient afforested lands of th Crown and the Barons, the laws and customs regulating them, the events of which they have been the scenes, and the changes that have taken place upon them.

Scientific Forestry.—Both as a department of botany, and an application of the teachings of chemistry, geology, mechanics, mineralogy, physiology, and zoology in their relation to the culture of trees, or Arboriculture; and to this may be added surveying, mensuration, draining, embanking, and such engineering as is implied in resisting the encroachment of sands, the prevention of landslips, the construction of roads, bridges, &c.

Legal Forestry.—Supplying an account of the laws and regulations made in this and other countries, for forest administration, conservation, and improvement; estimates of their working, records of their effects, and discussions as to their utility, together with suggestions for their alteration or amendment.

Sanitary Forestry.—Tracing the effects of trees in screening the soil from the scorching heat of the sun, in the diffusion of moisture through the air, in their aid to the circulation of water along the earth, and in their agency in regard to the radiation of heat; showing the interaction of vegetable and animal life on each other, the advantages of public parks and timber-trees in large cities, and many other ways in which trees promote the amelioration of climate and the increase of the general health of communities.

Economic Forestry. — Affording information concerning timber products and their uses in the thousand industrial arts to which they are essential; the species of wood most suitable for culture in particular neighbourhoods where there are special industries; the timber products having the best claim on growers on account of their utility and their relation to the wants of the community; and supplying forecasts of the timber requirements of future years, drawn from a knowledge of the progress of those trades in which wood is largely used.

Practical Forestry, or Arboriculture proper, *i. e.,* the planting and management of timber-trees as an investment and an industry, with all the questions which suggest themselves in actual experience as to climate and soil; raising from seed or planting from the nursery; methods of planting and the management of wood-growth; of thinning and pruning; of exposure and shelter; of the relative merits of mixed and simple plantations; of hedgerows and coppice-wood; of

profit and beauty; of game, and the injuries they commit; of fungi and insects; of accidents to, and diseases of trees, &c., &c. Here would be a space for pointing out the means to be adopted for avoiding the errors committed in wood-culture; for advocating and describing the planting of waste lands; for showing the comparative results obtained by planting, cropping, or grazing hill and moorland, and the returns yielded by capital so invested; for the exposition of theories on the distance and order at which trees should be planted; for explaining the causes of faults in wood and of decay in timber of various sorts; for showing the kinds of ground best suited for nurseries; for setting forth the grievances, arising from whatever cause, of foresters who have charge of policies and plantations, and for giving instructions on the duties of foresters, and enforcing their claims for considerate and wise treatment; for making known the money yield of timber as compared with the expense of its culture; and, in general, for the statement and explanation of the whole circle of questions which excite the interests of arboriculturists as wood growers.

Æsthetic Forestry.—Under which denomination we would range all matters relative to landscape gardening and planting for effect, ornamental plantations, public parks as places of recreation, the laying-out of pleasure-grounds and what trees are most suitable for them, the description of rare, beautiful, or extraordinary trees, together with notices of the trees of the poets and the poetry of trees.

Such, then, are some of the headings or branches of subjects into which the contents of the *Journal of Forestry* would, as it seems to us, divide themselves. Of course we have only indicated the main divisions, but there are many interesting matters which transcend any attempt to bring them under such classification. Such are, among others, biographical sketches of eminent arboriculturists; reports of meetings of societies interested in arboriculture; papers on the pecuniary stake which proprietors have in trees; the interest the nation has in timber conservation; the advantage of establishing National Schools of Forestry; the valuation of plantations; fossil forests, their products and their lessons; reviews and abstracts of books on arboriculture; essays on such topics as landscape beauty and tree-growth, the habits and habitats of trees; notices of the introduction of new species or varieties, and descriptions of them; the preparation of wood-products for the market, the evils of denudation, &c., &c.

Besides, too, there are the experiences of practical foresters to be gathered up and disseminated. Few men engaged in such pursuits are without their special opportunities for experimenting and of knowing—of seeing something others cannot see,

and observing in circumstances beyond the reach of others. An opportunity of putting these experiences into the common stock, and of enriching and enlivening others by describing them, will now be open to the intelligent foresters of Britain; and they cannot fail to confer benefit on their fellows by forwarding to us for insertion brief notes of curiosities of timber growth, singular experiences in their labours, and any ideas which may have suggested themselves by the observations available to them. For this and any other advantageous purpose we shall open for them *Our Editorial Letter Box*, for the reception of short notes of natural phenomena, facts, appropriate intelligence, and questions concerning Forestry. We have also reserved a space for the registration of appointments, removals, &c., and for such other little items of news about foresters and forestal affairs as may interest the class of readers to whom we address ourselves.

It will be readily seen how close the relations of the topics to be treated of in the *Journal of Forestry* are to those which relate to the management of estates, we have therefore chosen as a sub-title a phrase which indicates that such subjects as concern Estates Management have found a place in our programme, and shall in due course be incorporated in our columns. Many practical matters connected with the due culture, proper laying out, profitable administration, factorage, improvement and conduct of estates, so nearly akin to those relating to forestry occur that we think it likely that their consideration may be advantageously conjoined with the other objects of our magazine. In this, as in all other matters, we shall endeavour to bring before our readers what may be useful, instructive, and profitable; and as we shall open these pages impartially to all who have anything of real value, interest, and worth to say, it will greatly rest with our readers themselves to determine the character, quality, and nature of the contents of this Journal.

We have drawn up what may be thought a fancy sketch of the possibilities of our Magazine: but, if we are seconded, as we hope to be, by the staff of able contributors already secured, and by others —to whom we may justly look for aid—who possess ability and are willing to advance the cause of arboriculture, at home, abroad, and in the colonies, we do not fear but that the *Journal of Forestry* will soon take a leading place among the Serials of the United Kingdom.

We have been greatly encouraged and urged forward in our undertaking by the hearty interest shown, and the willing co-operation assured to us, by many of the leading members of the SCOTTISH ARBORICULTURAL SOCIETY, the only national organization under Royal patronage of which we are aware, devoted to the promoting and

furthering of scientific and practical Arboriculture. This association of Foresters, which numbers upwards of seven hundred noblemen, gentlemen, proprietors of woodlands, nurserymen, factors of estates, head foresters and their assistants, experienced labourers in timber culture, has frequently expressed a desire to see such a journal as we now offer established, and we believe we shall carry into this our new venture the hearty sympathies of the entire membership of that Association. We hope to be worthy of the confidence we seek, and we shall leave no effort untried to mature the contents of the *Journal of Forestry* so that each month we shall place in the hands of our readers not "leaves," but "seeds" and "fruits," the sterling products of observation, thought, experience, and interest to every arboriculturist in this land and in its colonies. Let all help, and then the entire constituency to which we appeal will have secured as their organ a journal to its own mind, animated by its interests, and vital with its own spirit.

EDITORIAL NOTES.

LOOKING abroad and seeing what has already been done by nearly every State in Europe, for the thorough education of foresters in scientific and practical arboriculture, we Britons must feel thoroughly ashamed of the feeble attempts we have made as a nation to promote the interests and advancement of such an important branch of our home and colonial industry. The subject has long been pressed on public attention, and ably advocated by many wise and far-seeing men, but still there has been no decisive action taken by the Government, or any other responsible party, to establish in the British Isles such a highly important and necessary institution as a School of Forestry.

Urged by the growing scarcity of timber for fuel and constructive purposes in our Indian possessions, and the crying want of a sufficient number of properly qualified men to undertake the superintendence of the magnificent forests which still exist in India, so as to increase and properly utilize their products, and to replant and cultivate in a proper manner those extensive tracts of forest land which have been ruthlessly cut down, cleared, or burnt, in bygone years, Her Majesty's Secretary of State for India felt the necessity of doing something to remedy the evil, and made a well-meant if abortive attempt to advance the status of arboriculture in this country, by sending a few well-educated youths to France and Germany to study forestry *at this country's expense*, for two years and a half; after which, to quote the words of the order, "they will be required to pass some time, probably not less than a month, with one or more approved foresters in Scotland"! in that short period of "*probably not less than a month*" they being expected to master the details of all the practice our most experienced Scotch foresters have spent a lifetime in acquiring. We take it for granted that that is what the Secretary for India meant when drawing up the regulations, but it is quite possible we may be mistaken, and the intention was for the Indian forest candidates to teach the Scotch foresters all the "forestry" they had managed to pick up in France and Germany; a matter, we agree, much easier for them to perform, and more suited for the time given, than our first supposition, that they came home to be taught forestry here. It is to be hoped that such a brilliant scheme has done much more for the

Indian forests than it has done, or is ever likely to do, for forestry a home. And why, we may ask, cannot men be found in this country properly qualified? Simply because no special effort has been made or provided in any way by which eligible young men can be taught the necessary duties and acquirements to fit them for such highly important appointments. "Charity begins at home," if it should not end there, but our wise authorities reverse the maxim, and expend a lot of money sending candidates for Indian forest appointments to foreign countries to learn what could be better and more profitably taught at home, if we only possessed such fully equipped institutions for the teaching of the science and practice of arboriculture as some third-rate German states are in possession of; to say nothing of the complete and elaborate Schools of Forestry belonging to the Governments of France at Nancy, Italy at Vallombrosa, and other first-rate establishments in almost every State in Europe.

We are already in this country in possession of the highest scientific and practical knowledge upon the subject, and it only requires to be properly organized and utilized to produce the most complete and efficient School of Forestry in existence. This being a national want,—in fact, a world-wide want—and of the highest importance to our national welfare, it becomes the duty of the Government to see that such an institution is established, and kept in a thoroughly efficient state. To do so will require an amount of means which the country will not grudge, any more than it does the large amount of public assistance given to all branches of education of national importance at the present day.

We are supported in the views we have expressed of the great necessity there is for immediately establishing a School of Forestry in Britain, by the concurring opinions of all who take an interest in the subject and understand its importance; amongst which we may mention the thoroughly-matured and experienced opinion of such eminent authorities as Dr. Hooker, Director of the Royal Gardens, Kew; and Dr. J. H. Balfour, Regius Professor of Botany in the University of Edinburgh, and ex-President of the Scottish Arboricultural Society.

The question as to where a Forest School ought to be first established in Great Britain is a subject of which the details may be left to future consideration, but the peculiar suitability and advantages which Edinburgh possesses for the establishment of such an institution has attracted much attention from those best qualified to judge, and we will revert to this subject at another time, when the negotiations now in progress for the formation of an arboretum at Inverleith, near Edinburgh, are completed. Meanwhile we would direct the attention of our readers to a pamphlet, quite recently published, by Dr. J. C.

Brown, entitled, "Schools of Forestry in Europe," noticed in another part of this Journal, in which he makes an able appeal for the establishment of a forest school at Edinburgh. We may add that it is necessary for a properly equipped Forest School to have a large extent of forest land attached to it, having a variety of elevations and soils suitable for the profitable cultivation of all our hardy trees; besides the garden nursery, or arboretum, which forms the nucleus, or head-quarters, for the schools. By proper arrangements, such an extent of suitable land could be got within easy reach of Edinburgh, along the slopes, amongst the glens, and upon the Pentland Hills; or, if for a school in England, amid the uplands of Surrey and Hants, or among the hills of Derbyshire, or in Wales, where trees thrive to perfection, and the land is of comparatively small value for any other purpose.

The Black Italian Poplar (*Populus Monilifera*) is well known to be one of our fastest-growing forest trees, the timber of which is much used in constructive work, where toughness and moderate elasticity combined are required. The tree is a native of North America, and is said to have been first brought to Italy, and thence to Britain; hence the common name "Black Italian poplar." It was first introduced into this country from Canada in 1772, and Loudon in writing of it some half-century ago says, "Its rate of growth in the climate of London, in good soil, is between thirty and forty feet in seven years, and in Scotland it has attained the height of seventy feet in sixteen years." Such rapid growth it is not likely to make in all cases, but there is a growing knowledge of the usefulness of the timber and the profitableness of the tree as a forest crop, and we have every confidence in recommending it to the attention of planters as a most valuable tree where the soil and climate are suitable to its nature. In corroboration of our opinion we have much pleasure in quoting the following letter from Mr. McLaren, the highly experienced and intelligent forester to the Earl of Hopetoun, Hopetoun House, Linlithgow. He says, "I am pleased to send you a few particulars about a fine black Italian poplar, containing eighty cubic feet of timber, which was cut down here last December. It was planted in 1824, in a mixed plantation of ash, elm, oak, maple, poplar, larch, and Scots fir; and after being cut down was sold at our public sale for £8 12s. 6d., being more than double the price received for any of the other kinds at the same age; the larch approaching nearest to it in size, and the price per tree it brought. It may be said that the soil suitable to the free growth of the poplar does not suit the other sorts; but while it was planted in

a damp spot peculiar to its healthy growth, the others were planted upon higher and drier ground, more congenial to their nature, so that they were upon equal terms in that respect. Another thing in favour of the black Italian poplar is, that from its upright habit of growth it can afford to stand closer upon the ground than any other common hardwood tree, and requires little or no pruning, naturally forming a straight and clean bole.

"It would be no great stretch of imagination to suppose that a Scotch acre would produce seventy trees worth £5 each in fifty years, which would yield a rental of £7 per acre per annum for that period, the thinnings and periodical cuttings having already paid the cost of planting and management."

THE chemists of the German Arboricultural and Agricultural Schools have made a thorough investigation into the properties and composition of forest tree leaves. They have found the chemical analysis of the leaves of several species of forest trees to be much richer in phosphates, and other fertilizing ingredients, than they generally get credit for in this country, so much so that we would call the attention of all interested to their value as excellent litter when collected and kept dry till used, and the valuable manure they make, according to analysis given by the German chemists. The following table of the constituents of beech, pine, and spruce leaves is taken from some recently published reports of investigations made in Bavaria, and for comparison we add to it the quantity of the various ingredients contained in a ton of wheat straw. It will be seen that beech leaves are fully as rich in fertilizing matter as wheat straw, and that pine and spruce leaves are very little inferior to it.

ANNUAL PRODUCE OF LEAVES FROM AN ACRE OF FOREST, AND ITS COMPOSITION COMPARED WITH THAT OF A TON OF WHEAT STRAW.

	Dry Matter.	Ash.	Potash	Lime.	Magnesia.	Phosphoric Acid.	Sulphuric Acid.
	lbs.						
Beech	2,972	165·5	1·80	73·18	10·90	9·32	3·23
Pine	2,842	41·5	4·32	16·84	4·28	3·28	1·51
Spruce	2,683	121·3	4·30	57·37	6·20	5·72	1.87
Wheat Straw ...	2,240	85·2	9·80	5·20	2·20	4·60	2·41

THE great demand for hop-poles, and the high prices obtained for them in the hop-growing districts, ought not to escape the notice of proprietors and foresters who are about to plant land suitable for pole-growing, or who may be on the outlook for the best market for

the disposal of moderately straight, clean-grown coppice and the thinnings of larch or other young plantations of a size and length suitable for hop-poles. To those who cannot find a good market for such produce in their own neighbourhood, but who may have easy access to a railway station or shipping port, the opportunity is a good one for effecting a profitable sale, which is not likely soon to fall off so long as Englishmen like a glass of good beer, and are wise and patriotic enough to prefer home-grown hops for brewing it.

We publish on another page a short letter from Mr. Burnet Landreth, Philadelphia, U.S.A., who is well known as one of the most energetic and enterprising gentlemen in the United States in everything relating to arboriculture and other rural affairs. It tends to show what a wide spread and deep interest is now being taken in forestry in all countries speaking the English language, and the great want felt for a British journal devoted to the interests and development of arboriculture; this it is our aim and ambition to supply; and, in furtherance thereof, we trust to receive many valuable contributions to our pages from our able correspondent and his fellow-arborists in America.

As the season for peeling oak bark has now commenced, we cordially invite foresters, managers of woodland property, and timber merchants who purchase a good deal of their oak timber standing, and fell and peel their own, to make use of this Journal as a medium for discussion on matters relating to bark. Such information as the number of tons (20 cwt.—2,240 lbs. avoirdupois) they are likely to offer for sale this season, also the demand "generally," in their respective neighbourhoods, naming their nearest and best market, with prices realized per ton last year, would be of the greatest value in enabling foresters to find the best market, and would also be a guide to the real market value, a desideratum long wanted by managers of woodlands and estate agents. We infer that in consequence of the diminished importation of tannery material which may be expected from Turkey and the East, bark will be much higher in price this season than it has been for years past; indeed, we have already heard on good authority that it is selling in some districts at an advance of from 20s. to 30s. per ton on last year's prices, hence it is important that foresters and others, before disposing of their bark this season, should be well posted as to the ruling prices, which can best be done by a free and mutual interchange of information.

On Some of the Summer Operations Beneficial to Plantations and Woodlands.

By ROBERT HUTCHISON, F.R.S.E.

One of the unwritten chapters in the science and practice of arboriculture is that detailing the duties and operations of the forester during the summer months, and the necessity for these being carefully attended to; and it may be well in the opening number of a *Journal of Forestry*, and at so opportune a season of the year, to devote a few pages to the consideration of so important a subject, and one hitherto so little referred to in the economy of woodlands.

The summer months, comprising as they do the period of nature's greatest activity and growth in the forest, no less than in the field, are perhaps apt to be looked upon by the general student of arboriculture as a season during which Nature in the richness of her greenery should be left alone in undisturbed activity; and it may be thought, perhaps, that any interference with her operations during such a time will only prove valueless, if not actually detrimental to ultimate desired results. There can, however, be no greater fallacy than such an hypothesis, for independently of his attention to many forester's duties, such as barking of timber, &c., which are appropriate only to the summer, the occupation of the practical woodman or arborist during this season may be otherwise a very busy one indeed, by contributing in many ways by his skilful treatment and observation, in assisting Nature during her greatest activity, in developing and perfecting her various interesting and marvellous processes of annual growth of tree and shrub, whether in woodland, hedgerow, or lordly park.

The practical forester who wishes to perform his duties in an enlightened and scientific manner, and with due regard to physiological distinctions and processes, must bear in mind that he has to deal with *living organisms*, and that his interferences with or operations against nature's laws—even when these, from exceptional circumstances, may be to some extent necessary,—if executed in a rash defiance of all that these laws inculcate, are certain to produce failure; and the living organism whose habits or economy he

is desirous of adapting to his particular requirements or wishes, will in his hands, shortly become a dead object. To obviate the risk of such treatment, it will be found by every practical tree-lover that the careful study of life-action in the forest at its most busy period is one of the most salutary methods; and while accurate observation, and experimental operations in forest work during the season of the sun's greatest glory and nature's richest garniture, will afford the highest interest and intellectual enjoyment to any one whose heart is in his profession, he will also find that by so studying the conditions under which tree and timber development proceeds best and most satisfactorily, such lessons, drawn from the flowing sap of Nature herself, will be of the utmost value to him in the practice and pursuit of his daily forest routine duties throughout the whole year.

The calendar of operations which usually accompanies our ordinary handbooks of forestry, deals principally with the summer months by directing attention to nursery rows and seedling beds, and such-like well-known essential but minor duties in the profession of the forester; but they do not sufficiently call attention to the work to be done *within the woodland itself*,—with the very trees themselves, in fact,—a point, in our opinion, equally, if not more important than any other in the varied range of details which it falls to the interesting occupation of the forester to consider and perform.

It is not, therefore, with such ordinary and minor duties as the details of nursery work that we propose to deal in this paper, although these very properly fall within the category of summer duties; but many of them, such as hoeing, weeding seedling beds, and keeping them clean, thinning, &c., may well be deputed to the *rôle* of any ordinary labourer; while the questions of greater importance, viz., the care and supervision of the woods themselves, and the operations in them, had better occupy the undivided attention of the professional forester. Unfortunately, in this country there is a propensity to set any mere ordinary labourer to do forest work; and such duties of the summer as we have indicated, are frequently delegated to any unskilled hand, while the work of the practical forester is confined to odd nursery jobs, barking timber, &c., to a far greater extent than is at all warrantable; and we would simply reverse these positions, and put "the right man in the right place," for all the work in that place during summer,—namely, the skilled forester in the growing plantations and woodlands. There are, no doubt, some operations outside the wood, but they are not very numerous, which fall more appropriately under the surpervision and personal administration of the forester, such as transplanting, harvesting bark after having been peeled, &c., but on the whole, the scene of greatest

importance for the activity of the forester during summer is *within the wood*, and were this better understood and attended to, much of the work remaining to be done during winter, and for which additional hands are required in many instances, would be vastly diminished, if not entirely dispensed with, and a more healthy mass of wood be found upon many an estate.

In the summer treatment of young plantations, say of any age under twenty years or thereby, there should be a very careful and elaborate examination of every individual tree, keeping well in view the ultimate object and intentions of the planter when the trees were first placed in the situation. The cutting over of many weak, straggling saplings, which, while they will never become trees themselves, merely serve to withdraw air, light, and soil nourishment from their healthier neighbours, will be more easily done at this period of the year than if left till the usual time of winter or spring thinning. Again, while the heavy foliage of summer clothes the larger branches and stems with rich luxuriance, it is then, more than at any other time, that the intelligent eye of the forester detects the "contiguity of shade" in some strong-growing head, or side limb rushing athwart his fellows, and by his wider expanse obstructing so much light, and casting such a dark shadow over them, that they have not the opportunity even of absorbing the light of the sun's rays on their leaf surfaces, or of exhaling in freedom from their shaded and darkened condition,—two functions most important to the healthy performance of leaf-action and its consequent utility in the economy of the tree.

In what is now recommended, it may be perhaps necessary to guard our remarks against some objections which might with propriety be advanced against them, if we are supposed to be advocating a general and thorough summer pruning of all trees indiscriminately. The pruning, as we have chosen to call it, is rather the removal when in a very young state of all rival leaders and incipient arms and branches, whether in the main or lateral shoots. It is to be done progressively, and so carefully must the operation be carried out, that it ought to be rather called a system of *training* than of pruning, and it will be found to be more beneficial to the tree in the long run, than any loss it may sustain by the removal of so limited a portion of its leaves. Many phytologists would shudder at the mere suggestion of the removal of leaves from any plant while they are in a condition to perform their natural functions, and it may appear that our plan infringes upon this most vital principle of nature, and no doubt to some extent this is true, but then those left are better exposed during the most important season of the leaf-action to absorb light and air, and are consequently able to perform their functions in a more complete manner. Moreover, it must be borne in mind that trees, in an overcrowded young planta-

tion, especially one of the mixed kind so generally adopted, and when the closely intertwined nurses of evergreen growth form so impenetrable a screen to air and light, are in precisely the same condition as those which have been subjected to unnecessary and severe destruction of leaves, because from their surroundings they are deficient in an amount of leaf surface adequate for the elaboration of the sap thrown into their system by the roots, and consequently the amount of wood formed annually will be considerably less than in such trees as stand apart, and whose leaves are more fully exposed to the very necessary action of both air and light. The system we advocate has long been practised with marked success in some of the largest plantations in the county of Dumfries, and which are acknowledged to be the best managed in that district.

At all times opposed to the lopping off or pruning of heavy limbs in large trees where it can be avoided, it appears to be only a truism to say, that were young plantations regularly gone over every summer, and the individual trees treated when necessary in the careful manner we have indicated, there would very seldom in after years when the trees have attained to some height, arise the necessity for pruning them in the manner so frequently done, and leaving awkward excrescences on their trunks by the removal of large limbs, thus marring the picturesque beauty of nature, and endangering the future health of the tree. It is with trees after they have attained to a considerable growth, and lost that adolescent form of bark peculiar to the young tree, as it is with the human system when severe operations become necessary; for it is not generally understood that *aged* trees, and those *beyond their prime*, will stand the mutilations of the woodman's saw or pruning-knife better than vigorous, healthy trees, operated upon before they have attained their full development. Surgical hospital statistics tell us that cases of amputation of the leg or arm—when performed between the ages of thirty and fifty years—are fatal in the proportion of one in every two cases, while between the ages of fifty and sixty-five, the same operations prove unsuccessful only in the proportion of one in every four cases, and as against one in every five cases in children or young lives: and so it is in the treatment of tree pruning; and if statistics were collected of such work, there is no doubt the successful operations would be found marvellously more numerous among either the cases of light foreshortening and disbudding of young trees from under fifteen to twenty feet in height, during the summer months, or of *very old trees*, which may have had large limbs removed during the ordinary winter season process, than in the cases of vigorous growing trees of from thirty years old and upwards, pruned even under the most favourable aspects both in regard to mode of execution and season.

But while by the judicious, light, summer pruning of young plantations an amount of benefit is secured for the plants in the vicinity of strong-growing and extravagant individuals, there is at the same time by the process much advantage conferred upon those trees themselves. For example, if a strong-growing sapling or young tree be not of a robust tapering stem, in summer when it shoots much, the weight of the abundant foliage in the head will bend the trunk, and induce a crooked bole, by the inclination of the head to one side or another, according to the quarter of the prevailing winds in the district; and in such an instance, by carefully removing some of the branches from the leaning side, and foreshortening others as may be requisite, the tree is enabled to regain a straight habit of growth, and what would in a few years have become an eyesore and valueless plant is converted into a promising timber-producing tree. In thus trimming and lightening the heads of over-luxuriant growers, and also in stopping the propensity to lateral growths in strong side branches, it should be borne in mind that in cutting off side shoots, say of less than an inch in diameter, from the stem, so as to throw as much vigour as possible into the leading terminal and its adjoining branches, it is advisable to do so alternately round the trunk or branch operated on,—that is to say, to endeavour not to leave one branch from the trunk or main stem of the branch right opposite another, for that will tend to induce a too sudden growth or thickness in the tree at that particular part; but they should be removed alternately, so that those remaining may appear one above another spirally round the young bole; in this way a more tapering habit in hardwood young plantation trees is induced, which ultimately tends to a larger capability of carrying an amount of valuable tall timber upon a given area of ground.

Another advantage secured by skilfully handling young plantations in the manner indicated is the freer admission of light to every plant, and the better circulation of air round each tree in the plantation. Thus the young wood is assisted in its annual ripening, and in the case of the coniferous family, individual specimens of rather tender habit are better and more quickly acclimatised, by the young shoots being thereby enabled to withstand with some degree of impunity the treacherous winds and sunny days of the later spring months; and by these means many a leader is saved which would otherwise have perished, and the growth of the tree upwards have been retarded.

Another advantage to be gained by the summer pruning of young trees is that when so treated they are not so liable to throw out around the wound a numerous crop of small twigs, which is a most undesirable habit, and one which is almost invariably the sequel to the cutting off, during the season of rest, of a heavy limb from hard-

wooded trees of strong healthy growth, such as elm, oak, chestnut, and other rough-barked varieties. A further benefit to be observed as resulting to young plantations from such summer treatment as has been indicated, is the prevention of the growth in woods, of fungi, lichens, mosses, and other parasites inimical to profitable timber culture. There are many varieties of fungi in different stages of development, popularly designated "mildew;" and it is well known that this abnormal parasitic growth is usually most to be observed upon unhealthy or stunted plants; whether itself causing the puny habit and diseased appearance, or whether selecting such trees as are of a sickly nature, is uncertain; but this much is sure, that plants or trees, and plantations, with a free healthy circulation of light and air through and around them, and which evince a vigorous and healthy well-nourished condition, are far more able to outgrow any such attacks, however severe, than the weakly stunted offsprings of an overcrowded, unpruned, slovenly attended-to plantation, whose rank grass and bracken overtops the small, and chokes the free circulation of air and light amongst the stems of the taller trees, making them harbours for these destructive enemies to lodge in, and prey upon them at leisure. The free circulation of air and light materially assists in deterring such growths; and the bark of the trees is kept in a much healthier condition, while many of the more destructive insects are thereby unable to find securely sheltered hatching-places for their larvæ in the crevices of unhealthy bark. Nor is this the least important advantage accruing from a general overhaul during summer of our woods and plantations, for the havoc and devastation caused by insects is far more than that resulting from any other agency; and besides, when once these pests have established themselves in any locality they are most difficult of dislodgment. In such cases it is well to adopt, where practicable, the motto usually applied to the medical profession, *Principiis obsta* (withstand beginnings), for, from the myriads of the enemy, and their persistent and tenacious attacks, the cure is frequently very difficult, and the insects are only eradicated in some instances by the sacrifice of the patient.

Another fruitful source of injury to forest lands and plantations, more particularly perhaps to Conifers, are the ravages committed by insects, caterpillars and moths. These marauders can also be most effectually dealt with and destroyed during the summer months, for then they are more easily seen and found than when, in the cold months of winter, they assume their dormant habits and forms, and are concealed beneath the bark, or in the soil, or in convenient crevices of stone, or rock, or decaying stumps.

In this department of forest knowledge it were well that the great

bulk of our head foresters were more thoroughly versed; for by a knowledge of the natural history of these insects, and by judicious preventive measures against their inroads and attacks, much benefit to the growing woods in many situations would result. The insects which are destructive to growing timber generally are of two descriptions. First, those which attack the deciduous or hardwood trees; and secondly, those which confine their ravages to the evergreen trees,—or rather, to those chiefly of the coniferous tribe. In regard to both of these classes, however, it may be said that the proper time for their destruction is the summer season. They include the May-bug (*Melolantha vulgaris*), which attacks both deciduous and coniferous or resinous trees and shrubs; the processionary moth (*Bombyx gastropacha processionea*), which is very injurious to the oak; also the *Melolantha hippocastani*, which is frequently very abundant upon and especially destructive to the horse-chestnut; and there is also a smaller beetle of the same family, the *Anisoplia* [*Melolantha*] *horticola*, which is principally the enemy of fruit-trees. The satin moth (*Bombyx Liparis Salicis*), is another great enemy in low damp situations to trees of the willow tribe planted in wet or moist positions; and in addition to these there are the buff-tip moth (*Bombyx Pygaera bucephala*), stripping the leaves of deciduous trees, as the oak, beech, birch, alder, and willow, and the large family of pine-destroying weevils or beetles. It does not fall within the scope of this paper to refer to the natural history of these destructive pests, further than to mention them as subjects for the interesting observation of the intelligent forester during the summer months in the woodlands, and by the destruction of which during his operations there at that season, he has it in his power to do much good to the plantations under his care.

An account of the ravages of these insects would no doubt form a most interesting narrative in forest history, and a complete description of the little animals, with their wonderful adaptations for carrying on their predatory work, would be most instructive; but these points would occupy far too much of our space, and would besides be beyond the scope of the subject we have in hand; and we accordingly confine our notice of these pests of the woodlands to the general statement that their annihilation during the summer months, in any localities where they have appeared, will be one of the greatest achievements of the forester's summer duties, and in the future will prove to have been one of the most thoroughly profitable and advantageous to the plantation. Where a tree is observed to be infested with insects, a careful search must be instituted for them and their larvæ, and should the search fail, the total destruction of the tree by burning is preferable to sparing it and trusting to other fortuitous circumstances of weather, thinning, or

pruning, to eradicate the evil. This item in the summer work of the forester is still but little understood, and a careful study of the natural history of the many injurious insects which are so very destructive to tree and shrub life, is a branch of the training of young foresters capable of much more development than it has at the present day attained. On the Continent, the injury done by these and kindred insects during the summer months has been frequently far more severe than in our own country: for example, in the Hartz Forest and other districts, sometimes hundreds of acres of healthy woodlands have been attacked and killed outright by the ravages of the fir tortrix (*Tortrix hireyniana*), rendering, in one single season, the labour and expenditure of years of no avail! Surely, then, we do not ask too much in craving the utmost attention of our foresters to the destruction of all such insect pests and their larvæ in our woodlands during the summer months.

But while we have thus noticed cursorily the forester's main duties *in the plantations*, so far as the treatment of the trees themselves in young and growing woods is concerned, there are many other very essential matters to engage his attention: for example, in small strips among trees of from two to six feet in height, there is the cutting and carrying away of the grass and undergrowth, so as to admit of a free current of air among the closely drawn stems, thereby preventing mildew and other bark excrescences, and bleeding, amongst coniferous trees; also the scouring out and opening up surface drains, and spreading of the *débris* and leaf-mould dug from them over the root area of the adjoining trees; the trenching and pitting open spaces, and throwing up the soil for aeration previously to the reception of young plants in autumn or spring; the lifting and transplanting specimen evergreen shrubs and trees,—which is a process, so far as the first-named are concerned, best done about midsummer. There is also the preparation of subjects for prospective transplantation in a year or two afterwards, by cutting round them and filling in fresh earth, thereby inducing a fibrous root-ball, with which the tree may be moved in safety to its new site.

Another most important summer operation, which is too frequently left till later in the year, but which can be best performed when the foliage of the wood is densest, is the selection and marking of such trees as ought to be either removed or felled when the proper season arrives. If this be left till the leaves are shed, or even partially so, many an intruder is apt to escape detection for that year, and probably when the next thinning of the plantation comes to be required, the mischief which ought to have been avoided has been done.

It is perhaps superfluous to notice many of the usual duties requisite during summer in the round of the forester's daily work. These

comprise the preparation of land intended to be planted, by enclosing it, draining, trenching, or ploughing, according as the situation and circumstances of the case require. The process of barking and harvesting bark will also occupy much of the earlier weeks of summer; and the repair of plantation enclosures, switching, and cleaning, by digging or forking round the roots of hedges, are other important tasks proper for the summer season, but unfortunately too often considered as unremunerative. And although we have insisted particularly upon attention to the duties more properly falling within the plantations themselves, supervision of nursery-ground operations should not be wholly neglected by the skilled woodman. The value of a small home nursery for aiding the forester in carrying out several of the incidental summer duties is great, by placing at his command, and within his reach, the materials for immediate use in filling any gap, or for the transplanting out of evergreen shrubs during the cloudy weather, at a time when such subjects could not safely be conveyed from a distance. Another important advantage derived from the possession of a home nursery at this season is that seedlings reared on the estate, and in the climate in which they are afterwards destined to grow, succeed better during their early years when planted out, than two-year transplanted seedlings fetched from a distance, and probably from a very different soil, climate, and altitude. This is particularly the case with some of the rarer and newer coniferæ, whose hardihood during the early years of their introduction was considered uncertain. Many of these, sown in home nurseries and afterwards planted out, by being gradually acclimatised from the very first period of growth have lived and thriven, when imported specimens of about one to two feet in height, though healthy and thriving in the sites from which they were brought, have failed, owing to the effects of late spring frosty winds. It will therefore be necessary, where the importance of home nurseries has led to their establishment, and the suggestion we have made is adopted, that the summer operations therein should also occupy the superintending eye of the forester. These, during this season, will comprise the destruction of all weeds, hoeing and loosening the soil about the younger and more tender seedlings, thinning, pinching out any double-headed shoots of the older plants, rubbing off superfluous or misplaced buds, attending to grafts by untying or fastening their bindings, as may be required, budding the more rare ornamental trees—an operation now becoming so popular, and which in most cases is best done about the month of July or early in August; —these, and other such minor tasks entailed by the existence of a home nursery, will add to the summer work of the forester additional interest and pleasure, and afford greater opportunities to the intelligent mind of studying and observing many of the most beautiful and instructive processes of Nature in her most secret economy.

The Beauty of Expression: its theory, and application to forest trees and landscape gardening.

By the Rev. J. G. MACVICAR, D.D., LL.D.

It may be truly said that the forester holds a place in art co-ordinate in importance with that of the architect. Nay, the vote might well be in his favour, were it not that the architect is capable of producing an amount of deformity and ugliness which nature will not permit in the forester.

It is a very fine saying of the poet,—

"God made the country and man made the town;"

and it might have been added that God keeps the country more than the town in His own hand. He is truly its proprietor, and, like every good proprietor, He is very jealous over his trees. In fact, to secure and to protect them He has arranged that if man destroys them it will be to his own cost, by destroying the soil and the shelter and the beauty of the landscape, and consequently the amount of life and enjoyment which his surroundings may impart to him.

The loss of shelter consequent on the felling of trees is obvious. The degradation of the soil in the same circumstances is not so obvious, and indeed depends greatly upon the latitude. On these points I do not propose to touch here and now; but I have something to say on the beauty and expression of trees, which appears to me not unworthy of the perusal of the readers of the *Journal of Forestry*. In fact, the enjoyment which is derived from the contemplation of the beauty of nature, and specially of the landscape, as being nature on the largest scale which the eye can take in, is one of the purest enjoyments which is accessible to man. It is also one of the simplest, and involves least trouble to obtain, and entails fewest responsibilities. It is, in fact, the cream of the enjoyment which the proprietor himself can have; while he on his part has much trouble and many cares. These, if haply they are associated with a rental, do indeed enable him to get many luxuries which the simple beholder of his property may have to go without. But there is not one of these luxuries which in point of pure enjoyment, without

the risk of repentance, can be compared with that which arises simply from the sight of the beauty of his domain and his home—

"Bosomed high in tufted trees."

On what, let us ask, does the pleasure depend which is awakened by the contemplation of a noble tree or beautifully wooded landscape? Let us put the question at once. Now to this may be answered in the most general terms, that this pleasure arises from a harmony between such a landscape and our emotional nature, in virtue of which the latter in beholding the landscape is brought into a state of active well-being, which, as reporting itself in consciousness, is enjoyment. How comes this about? To answer this, and to get at the root of the matter, we must keep in mind that feeling finds a haven and sabbath for itself only in one or other or both of two things. These are space and time. And these two, in reference to the landscape, mean, first, the *open* of earth and sky,—that is, the space in which the landscape lies; and, secondly, its suggestiveness of change, for such is the import of time. Now change implies activity, and activity in the last resort—nay, in its fountain, suggests life. Hence a twofold source of enjoyment in the contemplation of a beautiful landscape, namely, *form*—those forms of objects in it which seem in harmony with the spaces which they occupy; and *feature*—those features, whatever they may be, which suggest or awake in the mind of the beholder the idea of change and motion, in one word, life; for life is motion and change.

Now, corresponding to these two, it has always been felt that there are in a beautiful landscape, and in beautiful objects generally, two sources of beauty,—the one depending on the presence in those objects of *areas* of certain forms and colours, the other depending on certain *contours* or *lines*. And it will be found that the former is generally characterized as simple beauty, the other as expressive beauty, or the beauty of expression. As to the relative value of these two orders of the beautiful, it may be said that those observers who tend to be content with sensations merely when they are pleasing, are most content with simple beauty; those who tend to develop sensation into emotion and intellect enjoy expressive beauty most.

But on what special features in the landscape do these two differing castes of beauty mainly depend? To answer this question would require too many words for this communication. Let us here confine ourselves to the consideration of the latter kind of beauty—the beauty of expression,—both because it is the most interesting in itself, and because it is that which the tree pre-eminently possesses.

And here in the progress of our inquiry let it be first remarked that the beauty of expression is carried to the highest state of perfection in the human form. This fact will not be disputed. Neither

is there ground for denying that it is the very same lines in form and direction (though not in their limitations) which give expression to the forest tree and to the objects of landscape gardening generally, as impart expression to the human form and figure. Nor this only: the same lines, when they agree in form and direction, impart the same expression in both fields of observation.

The entire theory of the beautiful, whatever its field, is told in this, that all features in any objects of sense which are simple, and as we might say triumphant, displays of the operation of the laws of nature, are beautiful, and when beheld, awake a pleasing state of mind in the beholder. Nor is there anything mysterious in the fact that it should be so; for the embodied mind itself, when acting in a state of well-being, that is in a state of enjoyment, must act in harmony with the laws of nature; and therefore that the spectacle of those laws triumphant in external nature should awaken a state of enjoyment in the beholder is merely a case of harmony such as is to be expected. But may it not be said with truth, that all forms and movements in external nature are, without exception, in accordance with, and in fact wholly due to the operation of the laws of nature, and that therefore, according to the theory propounded, they ought all to be beautiful? Yes, this is true. But with regard to many objects, the laws which have determined their forms and movements are so manifold, that the mind in simply beholding the objects cannot take in all that they silently bespeak; and therefore is not touched by their beauty. And therefore it is that in propounding my theory of the beautiful I have introduced the word *simple.* Besides, there are many objects in nature which we cannot look at simply as they are, and in the first instance. We look at ourselves first, and then at them, and immediately comparing them with ourselves, we legitimately disparage them in this point of view, and vote them to be ugly. Such is the character we assign to the agile monkey, which, in consequence of his restless, suspicious, bounding, destructive disposition, and his snub nose, seems a devilish little manikin; while the barrel-shaped toad displeases us as suggesting to us the image of a gourmand or a dropsical individual.

But it is time to ask, what are those lines or contours on which the beauty of expression depends? Now to find this we must go to those realms where Nature accomplishes her laws most simply, and with the fewest complications, as, for instance, where the only force opposing her elect movements is the non-resisting ether; that is, we must look to the lines which she develops in the movements of the heavenly bodies and of light. These, it has been found, are without exception that series of continuous lines, all of which may be obtained by various sections of a cone, and which consequently are usually named the conic sections. The most simple are the circle, the

ellipse, the parabola, the hyperbola, and the straight line; and these are here mentioned in that order in which it may be said that equilibrium or repose prevails in the forces which generate or maintain them. The circle and the ellipse are finite. The orbits or objects contained under them are balanced or self-contained, or such as return into themselves. The parabola, the hyperbola, and the straight line are all aiming at the infinite. Neither of them is balanced so as to return upon itself or terminate in itself.

Now animation or life manifests itself in nature as an unbalanced force, and moreover in man as something on its way to the infinite. Hence, as symbolizing life, these lines of conic section are expressive in the order of their departure from the circle towards the other members. Thus, a sheet of water with a circular or elliptic margin, even though seen in profile, is a very poor object of regard compared with the sea, the horizon line of which immediately awakens the idea of the infinite.

I once met with a beautiful instance of the awakening of the emotion of the sublime—the emotion proper to the infinite, at the first sight of the horizon line of the sea in a mind in a state of simple nature. It was that of a nursemaid sent with the children under her charge to the sea-side for their health. She had never seen the sea before. And when the carriage had ascended the mountain-range beyond which lay the home of the family, and the sight of the sea broke upon her eyesight, her features brightened up with an expression at once of energy and repose, of which one would have thought that they were incapable, and after having feasted her gaze and asking what there was beyond, and receiving no answer, she answered herself by saying, "I think it must be the land of the leal."

So much for the simple conic sections. But here it is to be remembered that no sooner do we leave the orbits of the heavenly bodies and the realm of light where Nature reigns in all her grandeur and triumph; no sooner do we come to terrestrial objects, than we find that, as expressive of continually opposing forces, each of the conic lines must generally be taken as a trace or fragment only, and as extending in two opposite directions alternately convex and concave towards the same aspect. From this necessity the straight line alone is exempt. The arc of the circle gives an S-shaped line, while the elliptic arch gives that element of a waved line which Hogarth long ago celebrated in his "Analysis of Beauty" as "the line of beauty."

Of such lines there are many forms, according as they are composed of elliptic, parabolic, or hyperbolic elements; and their expressiveness increases in the order which is now indicated.

Now it is to be maintained that these principles of expression apply equally to all visible nature. They hold good equally of the forest

tree and the human face and figure. And as of these two the latter is the far simpler and more familiar, let us see how they apply to explain the expression of the human countenance and form.

We shall thus at once obtain the principles of a science of rational physiognomy—not indeed to be applied to our acquaintances or others, as if it gave a true index of their actual characters, because the outer and the inner man are but seldom in harmony; but it indicates what they were designed or tended naturally to be, though circumstances have made them to be different, and not to be judged by their appearance.

First, then, we say that the prevalence of the straight line in the human face and figure conveys the expression of energy aiming at the infinite—in other words, intellectual energy ever seeking its home in truth and righteousness, but with no tenderness or compassion.

And does not every one feel that a man of a columnar form standing in harmony with the laws of nature (gravitation), that is, upright; his shoulders as square or straight as the typé of the human form will permit without an offensive departure from it; his head also of the same character as his whole figure, high and quadrate; his chin, mouth, and eyebrows straight, his nose the same, all of course within the limits allowed under the type of humanity—does not every one feel, if he can picture to himself such a figure, or recall any senator, judge, or apostle as represented in marble or on canvas by an adequate artist, that such is really the expression of the straight line? And have we not here an explanation of the fact that when the object of society is to invest a man with the aspect of intelligence, righteousness, or religion, ever aiming at the infinite, it clothes him in a gown or robe that falls in simple folds, and renders his appearance as columnar as possible, filling up at the same time, for the same end, all the sinuosities and finite lines of the neck by a voluminous wig, such as the judges, &c., of old used to wear?

At the other end of the scale of the expression of the human figure is that in which the most finite of the conic lines appears most conspicuously, that is, the circle, and consequently (in a form of three dimensions), the sphere, or portions of it. Here in the extreme case we have a barrel-shaped body, a bullet-shaped head, eyebrows aiming at the semicircle, eyes and mouth gaping, bluffy cheeks, and nose aiming at the spherical, all as if modelled by a hand in a boxing glove in harmony with its own form. Who does not feel that such a mortal seems to be one of nature's most finite creatures, stupid to a degree, and if capable of animation at all, then only of that of the faun—the lowest of mythic beings in point of intelligence?

And here a very interesting fact comes out, on which, however, I shall not enlarge at present. It is to the effect that just as the

circle when displayed in a simple arch or simply arched segments is expressive of the absence of high life, intelligence, righteousness,—in a word, all that aims at the infinite, so when circular arches are coupled in an inverse or symmetrical way, thus generating an S or serpentine line, a form by which the "right" or straight line is not suggested at all, the expression is that which is the very opposite of intelligence and righteousness. It is, in short, diabolical or Satanic —a result which every one will feel to be not devoid of very interesting historical significance, as well as of the expression of individuals whom one meets too often, and never meets without a secret desire to part as soon as may be.

Intermediate between these extremes are all kinds of expressions in people who do not depart so far on either hand from the type of the human form as to be strange and displeasing to look at, and who are more or less pleasing in consequence of the possession more or less of both kinds of beauty, that namely of colour and surface, and that of contour or feature.

But I shall not go into further details here, in order that without being too tedious I may extend the theory of expression advanced one step further—a step which has special bearings upon the expression of the forest tree; and it is this,—that lines and contours are expressive of special states of life, according as they exist in directions which show successful resistance to the deadening power of merely material force, or are succumbing to it. The deadening power referred to is pre-eminently gravitation, affecting all bodies more or less with weight. Well, it will be found in reference to the human face and figure that the general difference between a cheerful or joyous expression on the one hand, and a depressed or melancholy expression on the other, all depends upon this—whether the mobile features, the whole attitude, the head, the eyebrows, the cheeks, the angles of the mouth, are kept up by the power of life triumphing over dead weight, or suffered to fall down in subjection to it.

In conclusion, all that has now been advanced applies to the objects which form the care and the delightful study of the forester and landscape gardener. I am much mistaken if he will not be surprised, when looking at the forest tree, or the clump, or the landscape as a whole, from the point of view here presented, to find to what an extent the eye in the most general contours before him detects the lines here advocated as the parents of beauty, including of course many modifications,—as, for instance, the *oval*, as well as the ellipse (which is the form that many trees project as their profile against the sky) and the isosceles *triangle* (which is that of the finest coniferæ), and which is truly a conic section (parallel to the axis of the cone), though not usually included among those lines, as indeed I omitted to do when enumerating them in this article.

The ground also so generally interferes with the aërial forms of plants that the hemispherical is more frequently given in the vegetable kingdom than the spherical, especially in the humbler forms of shrubs and trees and clumps.

But these things are for the discovery of the forester and landscape gardener, and I can only express a sincere wish that they may study the ideas and principles of beauty I have laid before them; and endeavour in their daily avocations to carry out those principles in entire harmony with nature.

Epping Forest.

THE scheme for the disafforesting that part of Waltham Forest, in the county of Essex, known as Epping Forest, and for the preservation and management of the waste lands of Epping Forest as settled by the Commissioners by virtue and in exercise of the directions and powers contained in the Epping Forest Act, has been settled within the last few days. After defining the lands subject to the scheme, it provides that the forest, on the day on which the scheme shall come into operation, shall be "disafforested," and upon such disafforestation the Queen's rights of vert and venison within the forest, several forest courts, and all letters patent, grants, appointments and warrants of any offices, bailiwicks, walks, and lodges, and all salaries, allowances, gratuities, and fees payable or allowed in respect of the same, and all burdens and restrictions arising out of the forest laws or customs, as regards the forest, cease and determine. The forest is henceforward to be regulated and managed in accordance with this scheme by the Lord Mayor, Commonalty, and citizens of London as Conservators thereof, acting in Common Council assembled. The Conservators are to appoint a committee, not exceeding twelve in number, to exercise with the Verderers the powers and directions and to do the acts which the Conservators are, by the scheme, empowered to exercise, Lieutenant-Colonel George Palmer, Alderman Sir Thomas White, the present Lord Mayor, and Sir Antonio Brady, the present surviving Verderers of Epping Forest, to retain the title of Verderers during their lives or until resignation of the office. All rights of cutting down trees and digging gravel and clay and loam, of cutting turf, common of turbary, common of estovers, rights of lopping and topping and cutting underwood, assignments of fuel or wood and other rights now subsisting in or upon the forest, either in respect of any office or by virtue of the forest laws, or of any licence, prescription, custom, or usage there are to be subject to the provisions of the scheme. The rights of common, of pasture, and "pannage" are to continue, and the parish vestries may nominate "reeves." The Conservators are to keep the forest unenclosed, and to prevent enclosures. The natural aspect of the forest and its ancient remains are also to be preserved. Churches, chapels, and charitable institutions are to be exempt from rent-charges. The Conservators are to have power to cut and manage timber and underwood, to plant trees for shelter or ornament, to maintain and dedicate roads, to build and repair lodges, to provide and maintain pounds, to make rules as to the regulation of common of pasture, to permit temporary commoning by drovers, and to permit sheep to depasture on certain conditions as to numbers, places, and times, and to allow Rifle Corps to drill.

The Beneficial Influence of Trees.

By LEWIS BAYNE, Forester, Kinmel Park.

Practical forestry is considered by many to consist of the planting and rearing of plantations, with a view to the production of the greatest quantity of timber, of the best possible quality, in the shortest time, and with the smallest expenditure, on a given space of land. Such is, no doubt, one of its greatest objects, never to be lost sight of by the forester who undertakes the management of plantations, whether for profit, ornament, or shelter. A proprietor, however, who considers that the direct revenue produced from the sales of his timber, &c., the only benefit he receives from his woods, who puts no value or consideration upon the improved appearance which plantations give to his property, and who overlooks the indirect profits and benefits derived from their shelter, and the influence for good which they exercise on the climate, takes a very narrow and partial view of the matter.

The beneficial effect of trees and shrubs on climate and temperature, whether planted in large bodies, in smaller groups, or singly, is very marked and of the utmost importance, as from their judicious distribution the summers are made more cool and the winters more genial and warm. In other words, they equalize to a great extent the temperature both of summer and winter, by modifying the extreme heat of the one and the extreme cold of the other.

The influence of trees and forests on the rainfall of a country is very generally admitted, and this is specially worthy of consideration at the present time, when thorough draining—one of the foremost of agricultural improvements—is being so extensively carried out.

There is possibly no class of men who have a greater abhorrence of trees and plantations than the tenant farmers;* we find them in this neighbourhood, as elsewhere, waging a continual warfare against trees in the vicinity of their fields, alleging as a reason either that the roots absorb nutriment from and exhaust the land under crop in parts of the fields adjoining the trees, or that nothing will grow under their shade. The

[*We are glad to know a different feeling prevails amongst farmers in many parts of the country, which we trust will become general as education advances and the subject is better understood.—Ed: *J. F.*]

first plea, it must be admitted, is not altogether without foundation in cases where surface-rooting trees have been planted in hedgerows, and this style of planting is not to be recommended or encouraged, as trees so planted are quite unnecessary where a proper quantity of trees exist in neighbouring well laid-out plantations. The beneficial influence of plantations as shelter to farm lands and crops is apparent and indisputable, and requires no argument or evidence. Without shelter good crops will not be obtained at high elevations, even on moderate soils; and it has been known, in cases where land without shelter was not worth cultivation, when portions of it were planted, the remainder became good pasture, and yielded a fair return on the cost of labour in cropping it. From the amelioration of the climate and the shelter trees in sufficient quantities produce, their beneficial effect on agricultural crops is very considerable. The finer and more nutritive and productive crops can be grown on the same land, while the mere growing of these crops tends to improve the nature and quality of the soil itself. Further, the land on which trees themselves grow improves by their cultivation. It will be found that after the trees have arrived at a size sufficiently large as not to be injured by sheep, the ground will be better fitted for grazing than before the trees were planted; this arises not only from the shelter produced, but from the improvement of the soil by the accumulation of fallen leaves and decayed herbage,—the growth of herbage being promoted by the better shade and shelter afforded, as well as the action of the roots of the trees in pulverizing and loosening the ground in which they are growing. It will also be found that even when the crop of trees has been cut down, instead of the land having become exhausted, and rendered unfit for pasturing or agricultural purposes, it will be much improved.

But the influence of trees, in improving the climate of a district and producing shelter to the crops, is not the only benefit derived from plantations, as the stock which graze such land is also thereby benefited. In extreme cold and bleak situations animals cannot improve upon the same food as upon well-sheltered land; not only so, but when a storm is approaching, they are to be seen standing close up to the nearest fence for shelter, without feeding in any way; whereas in the vicinity of plantations they can browse and feed without feeling the effects of any moderate storm. Even in extreme cases the shelter derived from plantations, although at some distance, is considerable. The influence of trees upon climate and vegetation not only affords more food and comfort for animals, but enables the farmer to keep a better and more valuable class of stock than he otherwise could do, with improved pasture and shelter in high-lying and exposed situations.

In addition to, and irrespective of the improvement of climate, the shelter, shade, and other advantages derived from plantations, all above adverted to, trees are useful in yet another character, that is, they improve the appearance of the country, and that to a greater extent than any other product of the vegetable kingdom. What appearance, it may be asked, would our island have without trees and shrubs? How monotonous and uninteresting!

Trees! They are the grandest and noblest products of the soil—the best means of diversifying the appearance of a country; of adorning and adding beauty and grandeur to the landscape, whether on the plain or the rugged mountain side. From the various heights, colour of foliage, and habits of growth of trees and shrubs, they are most useful in improving the scenery, whether in connection with mountains, rocks, or water; they give variety, and an appearance of greater luxuriance to plains and flat monotonous districts; in undulating districts, by planting with taste the higher parts of the ground, they add to the boldness of the landscape; while the bare mountain-sides, looking cold, bleak, and barren, when clothed with trees not only assume a grand and picturesque appearance, but put on, as it were, a look of fertility, warmth, and richness.

Without touching on the direct revenue to be derived from plantations, these remarks merely point to a few of the indirect benefits which proprietors derive from judiciously formed and carefully laid-out plantations, and are offered as an humble plea for the more extensive cultivation of trees and shrubs in high-lying districts.

Table of Comparative Prices realized per cubic foot for Forest Produce in different districts in Great Britain during last Winter, made up from Actual Returns from each locality.

NOTE.—We regret that several valuable returns kindly furnished by correspondents cannot be tabulated herewith, as the quotations given vary considerably according to the custom sale, &c., of the particular locality, being sometimes per foot or per load, and the prices quoted being sometimes for standing Timber, or for Wood delivered at a station, &c. We shall arrange in future to avoid this confusion by issuing a uniform style of schedule to be filled up by our correspondents, so that our columns of Returns may be as universally accurate as possible, and all Returns be given on one plan.—*Ed. J. F.*

County and Locality.	Oak.		Ash.		Elm.		Beech.		Plane.		H. Chestnut.		S. Chestnut.		Poplar.		Alder.		Walnut.		Birch.		Lime.		Willow.		Larch.		Spruce.		Scot. Fir.		Silver Fir.		Bark Per Ton.		Remarks.
	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	1st qly.	2nd qly.	Oak.	Larch.	
	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	s d	£ s d	£ s d	
ENGLAND.																																					
Herefordshire	3 6	1 3	2 0	1 0	1 2	0 8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1 3	1 0	...	...	...	...	...	...	...	...	Prices here during winter have been 15 to 25 per cent. lower than the average of 4 years.
,, Leominster	3 0	1 3	2 0	1 2	1 0	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1 3	1 0	...	...	...	...	...	...	...	...	
Norfolk, Ipswich	2 6	2 0	1 9	1 6	1 6	1 0	1 3	1 0	2 6	1 6	1 0	10	1 9	1 6	10	8	8	...	...	...	8	...	1 3	1 0	1 6	1 0	1 3	1 0	0 8	0 6	10	0 8	..	...	5 0 0	...	Tendency in prices been downwards. Per 21 cwt. in the woods.
Notts, Basford	3 0	1 6	2 6	1 6	1 6	1 0	2 0	1 0	3 0	1 0	...	...	...	...	1 6	1 0	1 2	10	...	...	1 3	9	2 0	...	2 6	1 6	2 0	1 0	10	0 8	10	0 8	..	...	...	...	
Wilts, Longleat	3 6	1 6	3 6	1 6	1 9	1 0	1 6	1 0	4 0	1 6	1 6	10	1 6	10	1 6	10	1 6	10	4 0	1 6	...	...	3 6	1 6	1 6	10	1 3	1 0	1 0	10	1 0	10	...	...	5 2 6	...	
Yorkshire, Loftus-in-Cleveland ...	1 6	1 4	1 4	1 0	1 0	...	1 0	0 9	...	0 9	...	...	...	...	1 0	9	...	8	...	...	...	...	...	...	...	...	...	...	...	...	..	0 8	0 8	...	...	...	
Do. Doncaster... ...	...	0 9	1 6	1 0	...	10	...	...	...	...	...	...	...	...	1 0	...	...	10	...	...	...	10	...	...	...	...	...	10	...	0 6	...	0 6	...	...	...	...	
Somersetshire, East ...	1 8	1 6	1 3	1 0	1 3	1 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1 0	...	...	...	...	...	...	...	...	3 to 4 miles from railway station.
Suffolk, Wickham Market	2 6	1 6	2 0	1 3	1 6	1 0	1 3	1 0	1 3	...	1 9	1 3	2 3	1 3	1 0	6	8	4 3	0 1	3	8	0 4	2 0	1 0	1 9	1 3	1 6	1 0	0 8	0 6	10	0 6	...	...	...	...	
Hants	3 0	22	2 6	22	1 8	10	22	1 0	...	...	1 0	8	2 3	1 2	...	...	1 0	8	...	1 0	8	2 3	1 6	...	...	...	1 6	10	1 2	0 9	1 0	0 8	...	...	...	...	Demand during the season limited, all expenses of felling and removing defrayed by purchasers.
SCOTLAND.																																					
Berwickshire, Earlston ...	2 6	1 6	...	...	1 6	1 0	...	...	3 6	2 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1 3	11	...	...	...	0 8	...	...	...	...	Larch net stakes 5 feet long and 1½ dia. at top, sell at 20s. per 100, 1 mile from station.
Linlithgowshire, Hopetoun	2 6	1 5	2 6	1 8	2 0	1 6	1 6	1 0	4 9	3 0	...	...	1 8	1 2	2 0	1 9	...	...	...	...	...	...	2 4	1 8	1 6	1 2	1 6	1 1	...	...	1 0	10	...	...	...	...	
Dumbartonshire, Rossdhu	2 3	1 4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1 2	10	...	...	0 8	4½	...	..	3 5 0	4 0 0	These prices are for standing timber, to be cut and peeled by purchasers.
Banffshire, Cullen... ...	4 0	2 6	4 6	1 6	3 6	2 6	2 0	1 6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2 0	1 0	1 3	10	1 6	1 0	1 4	1 0	...	...	
Morayshire...	2 6	1 6	3 3	2 6	2 6	2 3	2 0	...	...	...	...	...	...	...	...	...	1 4	...	...	...	...	...	...	...	...	..	1 6	1 3	...	...	0 8	0 7	...	...	...	...	Prices vary according to distance from railway and state of roads.
WALES.																																					
Denbighshire, Kinmel ...	...	1 6	1 0	10	1 3	10	1 0	10	...	1 3	...	10	1 3	8	10	8	...	9	...	...	...	9	...	10	...	...	...	1 0	...	0 9	...	0 9	...	...	...	...	
North Carmarthenshire and Cardiganshire ...	2 6	1 2	2 0	1 0	...	...	...	...	...	...	...	...	...	...	...	...	0 7	0 9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5 10 0	...	

In compiling the foregoing returns from a mass of very interesting information kindly sent to us from many localities throughout the United Kingdom, we have found it very difficult to do justice to all the information submitted to us, as much of it, while directly bearing on the range of relative prices of forest produce in different districts, contains information beyond the columns of our tables, and we are therefore led to supplement our tabular matter by some facts communicated to us by valued correspondents in various counties. In estimating the value of forest produce in different quarters, there are several elements which play no inconsiderable part in the calculation, and which must be taken into account in comparing the price of one variety of wood with that of the same in a different locality. These circumstances to which we refer are the size and scantling and consequent intrinsic value of the timber, its position when felled in the wood, and comparative ease of transit to port of shipment, railway station, or market, and the condition of the roads over which such intermediate conveyance is required, and also the distance from a roadside railway station to the nearest great centre of use or manufacture. Another difficulty in comparing the relative prices of forest produce in different localities arises from the different customs prevalent in regard to the sales in different counties and districts. Thus, for example, we find in West Sussex that oak is usually quoted *standing with lop and top and bark*, at so much per load of fifty feet according to size and dimensions of the trees. Again, in places where owing to the nature of the soil, or from other reasons, the quality of timber, or its size, only renders it suitable for inferior purposes, such as pitwood props, &c., the prices quoted from such districts will not bear favourable or even *fair* comparison with those of heavy tall timber felled in other counties and of the very highest quality.

Again, when there is a good local demand from any particular reason, the prices of even inferior quality of wood will compare better with those of other districts than they are intrinsically entitled to do. Thus, for example, in Banffshire the quotations are higher than in most other counties in Scotland. This, no doubt, is owing to the demand and consumption being local. Most of the timber grown within ten miles of the coast is used in ship and boat building, or in connection with harbours, fish curing, herring barrels, &c. Till recently only certain kinds of wood were allowed by law to be used for the manufacture of herring barrels; recent legislation has, however, changed this embargo on other woods, and now any kind of timber, including larch, may be used.

The demand being almost exclusively local is influenced by local causes, such as successful or unsuccessful herring and haddock fishings. Last year being in general poor, herring fishing told prejudicially

against the shipbuilding and more particularly the boatbuilding trade. In autumn last, when orders were usually given for new boats, few were contracted for, hence the autumn auction sales, at which the wood and timber for winter use are bought, were upon the whole depressed and dull.

In addition to the quotations given in the prefixed table, it may be stated that the following prices are obtained for miscellaneous produce:—Roots for deck supports—larch, oak, and elm—about 5s. per claus, or the whole root from 10s. to 30s. each according to size and adaptability. The other descriptions of wood—such as alder, birch, lime, sycamore, and coarse tops and limbs of timber trees—are sold by the ton for fish curing, and realize for that purpose prices varying from 12s. to 20s. according to kind and quality, birch being of all others the most preferable wood. Branches, spray, and prunings of trees generally are sold either by the cart-load or by slump. Such produce being often in places difficult of access, has therefore to be removed in small quantities; hence the advantages to both seller and buyer in making the purchase by lot instead of load. Though, as already stated, sales in autumn in this locality were dull and languid, in spring they have greatly revived, and are at this date as high as ever they were in this part of the country.

From Scotland we have a very interesting report from Rossdhu, Dumbartonshire, and which we embrace the opportunity of giving to our readers, as it contains in a narrative form some valuable statistics of forest produce returns:—

"In September of last year there was offered for sale by private tender a very large and excellent lot of larch and Scotch fir growing on this estate. The wood in question was 90 years old, and, in point of economy, ought to have been disposed of sixteen or twenty years ago. It was growing on a hill called *Old Mulea*, and formed part of a very pleasant piece of landscape as seen from the ever-beautiful Loch Lomond. The altitude of the situation ranges from 200 to 600 feet above the level of the sea; and at the highest points of the wood not a few larch trees are growing that measure over seventy cubic feet. The largest tree in this wood is a larch measuring 138 cubic feet. The proportion of Scotch fir to larch is as 2 to 3 nearly; total number of trees about 11,000; area about 120 acres. The surface is above whinstone, with rapid slope and fine exposure,—in short, the very ideal of a larch-growing situation. The leaves, buds, and bark of the Scotch fir tell plainly of its purity as the nativeplant.

"This fine lot, which it would be found difficult to match in the country, was sold to Messrs. John Edmond and Son, wood merchants, Drymen, Stirlingshire, for the sum of eight thousand six hundred pounds (£8,600).

"Owing to the considerable distance of the district from a market the prices realized for wood on the ground are by no means high.

"In February of this year a hag of oak coppice was offered for sale by public auction. Along with this coppice there were between 200 and 300 oak standards from 40 to 100 years old, and 300, or thereby, larch trees from 20 to 60 years old, and also a quantity of small birch, beech, and alder. The whole lot was purchased by Messrs. Richard McLean and Son, wood merchants, Callander, for the sum of nine hundred and eighty-six pounds (£986).

"The estimated weight of bark is 136 tons."

Travelling further south, we find in Wiltshire, as in many other parts of England, the utmost divergence of custom in realizing the produce of the forest, and we therefore, as one out of many instances, give the particulars of the use and wont and mode of dealing in Wiltshire, premising that almost each county or central market for wood disposal has its own custom. From the return kindly given to us from Longleat we are informed that the distance from a railway station is from three to five miles, and that the nearest market for pitwood is from ten to twelve miles distant. "The home timber trade has not been brisk for eighteen months or more, and it is still dull and depressed. Previous years' prices are scarcely obtainable, particularly in the case of second-rate and inferior timber. Copse-grown ash is in most request, and commands a ready sale at a high price—a fact which ought to convey a lesson to planters having an eye to the future wants of the timber trade; in a favourable soil and site it should be planted in preference to any other kind of hardwood, as it is almost certain to prove the most profitable timber tree for extensive planting. Oak timber of first quality and of large girths is in fair demand, but the small and secondary class does not find a ready sale, consequently the prices for this latter description of timber are lower. English elm of long lengths, clean, sound, and of large girths, is in request. Wych elm of first quality sells readily at a fair price. Lime of good quality is eagerly sought after; it is a valuable, and at the same time an ornamental timber tree; in good soils and rather sheltered situations it is a fast grower, and would be a profitable tree to plant. Beech, if clean and upwards of 12-inch quarter girth, is readily sold at previous prices. Sycamore is of little value unless upwards of 21 inches quarter girth, and must be very clean grown; butts of this description sell higher than almost any other kind of British grown timber; it is used for rollers in many kinds of machinery, and I believe the best market for sycamore is in Manchester, where it is used extensively in the cotton mills for rollers. Alder, Spanish chestnut, poplar, and willow timber is not in much request in this locality. Walnut, when old, dark-coloured, and richly figured, sells at a good price; the larger roots

of this tree should always be grubbed out intact with the butts, as they are often more richly mottled than the stem, and in consequence the root end is often the most valuable portion of the tree, therefore the roots should be measured along with the butt. Larch, Scotch and spruce firs, find a ready sale.

"The price of bark varies throughout the country, from £5 to £6 15s., the difference being chiefly caused by delivering the bark at the nearest railway station, or at the tan yard; also some allow 20 cwt., others 21 cwt. and 22 cwt. to the ton; and on some estates it is sold chopped and delivered in bags. It would be well when the price of bark is quoted that the conditions of sale should be stated.

"Pitwood is selling at fully 5s. per ton lower than it did two years ago; first quality, larch, 14s. to 16s. per ton of 20 cwt.; second do., Scotch and spruce fir, &c., 12s. to 13s.

"Underwood, 14 years growth, yields from £3 to £10 per acre; it is cut by our own woodman, and sold in drift lots, varying in length from 50 to 400 perches each, at per perch. The chief trade for underwood produce in this neighbourhood is wattle hurdle-making for sheep-pens; they sell at 8s. to 10s. per doz.: other underwood produce is as follows:—ash and Spanish chestnut poles (for fencing), 15s. to 20s. per. ton; alder do. (for chair-making and brush heads), 10s. to 15s. do.; fagots, 18s. to 20s. per 100 (of 6 score); spade and rake stems 9d. per doz.; rose and dahlia stakes, 4d. per. doz.; kidney beans do., 6d. to 9d. per bundle of 50; peawood, 3d. to 4d. per bundle; birch for besoms, 4d. to 6d. per. bundle. Underwood in this locality is in fair demand for hurdle-making material, being in great request generally realizes its worth."

In Ireland, again, we have a different mode of selling felled timber very prevalent, as, for instance, in county Tipperary. From a return given us from Ballinscourt, we learn (and it is no unusual custom) that the system of selling is by the ton weight or by the tree. Very little is sold by measurement, unless special and gross trees. In county Clare, distant fourteen miles from a railway station, clean oak, suitable for spokes, fetches 18s. per ton; if gross enough for shipbuilding, 2s. to 2s. 4d. per cubic foot; ash, 1s. 4d. to 1s. 8d. per cubic foot; beech under 15in. diameter at 11 feet, 6s. per ton, but when over 15in. diameter at 11 feet, £4 to £7 per log; sycamore, 2s. 2d. per cubic foot; birch, 7s. per ton; elm (gross), 2s. 6d. per cubic foot; larch, 16s. per ton; Scots fir, 8s. per ton; crab apple of 9in. diameter, 2s. 6d. to 3s. 6d. per lineal foot; oak bark, £7 10s. per ton, delivered in rick. In Tipperary, 5,000 tons of larch thinnings, thirty years old, have been sold from one estate at 18s. per ton, to be felled and removed at purchaser's expense. Larger trees at from 20s. to 22s. per ton; Scots fir thinnings, 8s. per ton.

Ancient English Forest Laws.

FORESTRY in this country, having, by the vast superiority of the demand for timber over our home-grown supplies, produced an enormous import of foreign wood which we cannot possibly dispense with, and would rather have increased, our old English forest laws have become rather rusty, there being no necessity to furbish them up, to make them suit the requirements of the present times, as we do not now depend to any appreciable extent upon home-grown timber. Yet the laws by which our forests were protected in bygone days cannot fail to be of interest. However tyrannous in some respects the ordinances respecting forests might be before the Conquest, that event no doubt increased the sufferings of the English a thousandfold, from the rigorous manner in which they were forced to provide for the sport and diversion of the victorious invader. The devastation caused by the creation of the New Forest in Hampshire was so excessive and cruel, that, notwithstanding the concurrent testimony of contemporary historians, it has not always been credited by later writers. William the Conqueror did not plant the New Forest, but afforested a large district of wood, hill, and champaign, at that time peopled and under cultivation, and by depopulating the villages which it contained, and diverting its lands from tillage, he rendered it fit for hunting, regardless of the misery by which his amusement was purchased. Holinshed denounces William's penal forest laws as a "pestilent policie of a spitefull mind." Spelman has collected the several judgments with which the Conqueror's family was believed to have been visited, within the precincts of the New Forest, on account of his oppressive conduct. Richard I. renewed severe laws against transgressors in his forests, putting out their eyes and inflicting still more horrible punishments, as in the reign of his great-grandfather. Cutting off hands and feet was also practised as a punishment for the transgression of forest laws. John, in the early part of his reign, exercised the forest laws with unmitigated severity. So tenaciously did the king cling to his rights that a sentence in Magna Charta gave him the same sovereignty over the forests which his father possessed. Whereas, in the *Carta de Foresta* of Henry III., the king agrees, among other things to a new perambulation of the forests, to disafforest such portions as appear to have been unjustly afforested; more especially all such as

Richard I. had converted to his own use, and capital punishment and mutilation were struck out of the code; but notwithstanding the grant of this charter, the exactions of the Justices of the Forest appear to have been very grievous during the reign of Henry III. The barons wrung from Edward I., in 1297, a full and free confirmation of the *Carta de Forestâ*, and from that time it has never been disputed. Charles I., amongst other attempts against the liberty of the subject, tried to revive its ancient and forgotten power, but he failed. Manwood gives an elaborate account of the manner of erecting a forest, which appears to have been made for the special delight and recreation of the king; venison, and not timber, being the article wanted, the latter was merely planted to afford shade and food for the former In Elizabeth's time (and some of the ancient routine clings to us yet) a forest had its own courts:—1. The Justices' Seat, or Court of the Justice in Eyre, held not oftener than every third year, to take cognizance of trespasses, pleas, and causes within the forest. 2. The Swainemote, or assembly of the freeholders of the forest, held thrice a year to make inquests and juries, and to receive and try presentments againsts offences in vert, or everything bearing green leaves 3. The Woodmote or Court of Attachment, held every forty days to receive and inquire into presentments, but not to convict. 4. The Court of Regard, held every third year for the survey and "Expidation of Dogs."

The Chief Justices in Eyre were appointed by Henry I. in 1184, and were only abolished by 57 George III., their places having become sinecures owing to the disuse of the forest laws. The Chief Warden might bail and discharge offenders, but not give judgment whenever a castle exists in a forest, as the constable of that castle is chief warden of the forest. Verderers are judicial officers chosen in full county by the king's writ, they are chief judges of the Swainemote; Regarders superintend the forest and inquire into offences; Foresters watch over vert and venison, and make attachments and presentments for trespasses; Woodwards look especially to the timber and vert; a Riding Forester rides with the king in hunting; Agisters take care of the *agistment* and pasturage of cattle; Rangers re-chase beasts which stray into the purlieus; Beadles warn courts, make proclamations, serve processes, &c. Besides these there are also keepers, bailiffs, and other minor officers.

Besides the forest itself there is the *purlieu*, which is in some sort under forest law. These were such additions as were illegally made to the original forests at the time in which the *Carta de Forestâ* was given. Hence purlieus are free of vert and venison to those who have woods or lands in them, but not to others. Amongst forest offences is that of "wast," which is cutting down

wood, even on a man's own freehold, within the forest without licence. It is a corruption of the Latin *vastare.* To *assart,* is to cut down trees or shrubs frequented by the beasts of the forest; and "purpresture" is an encroachment on the forest by building, enclosure, &c., an offence which must have been committed pretty freely of late years. Either by repeal, by Act of Parliament, or by long disuse, forest laws have altered materially, but only one well-conversant in this species of legal lore can, with any degree of certainty, determine which of the ancient decrees are yet in force. Before the reign of Henry VIII. a list of sixty-eight forests is given as existing in England, the date being fixed as before the reign of Henry VIII. by the omission of Hampton Court. The commissioners appointed during the reign of George III. to inquire into the state of the woods, forests, and land revenues of the Crown, presented to Parliament seventeen reports between 1787 and 1793. Various Acts have subsequently been framed upon these reports, by which certain forests are disafforested, or enclosed in part or in whole, the bounds of others are ascertained, and permission is given for exchange or alienation.

Price of Hop Poles.

In spite of the preservation of hop-poles by the creosoting process, their price has increased very much latterly, so that good 16 feet poles for Golding hops, used mainly in East and Mid-Kent and Hants, cost at least 55s. per 100 poles when they are creosoted and got on the lands. As three of these are put to one hill, at least 3,000 are required per acre, so that the cost of providing one acre of Golding hops with suitable poles would be £82 10s. Useful 14 feet coppice-grown poles cost at least 35s. per 100 poles before they are ready to set up; and really good poles, grown in 'plantations,' chiefly ash and chestnut of from nine to ten years' growth, cost quite 40s. per 100, or £60 per acre. Fourteen feet poles are put to Goldings in poorer soils. and to Bramlings and less biny sorts of Goldings in Kent and Hants. The cost of 12 feet poles, which are used for Grapes and Jones' hops chiefly, ranges from 25s. to 28s. per 100, and the cost of providing an acre with poles of this size would be about £46. The annual average cost of 'furnishing' an acre of hops, to supply the place of those broken by accident or by wind, or decay in course of time, varies from £4 to £5, according to the sort of hops. Fir poles, which some growers affect, cost from 10 to 15 per cent. more than other sorts. Quantities of these are brought from Norway, and are for the most part straight and well grown. Many are also sent from Belgium, but they are not so straight as the Norwegians. Woodland is being grubbed to such an extent throughout Kent and Sussex that poles must be much dearer still, especially if the hop acreage increases during the next few years in the same ratio that it has increased during the last seven years, for it will be found upon reference to the Agricultural Returns, that from 1870 to 1877 over 10,000 acres have been added to the English hop plantations during that period.—*Agricultural Gazette.*

Spruce Timber.

By W. McCORQUODALE, FORESTER AND WOOD SURVEYOR,
SCONE PALACE, PERTH.

Some time ago Mr. C. Graham Smith read a very able paper before the Liverpool Polytechnic Society, on the different varieties of pine and fir timber, remarking on their respective qualifications for engineering purposes, &c., extracts of which were published in the *Timber Trades Journal* of the 3rd of March last.

I am sorry to observe some of Mr. Smith's remarks on spruce timber. He says :—

"Spruce being strong, tough, and straight-grained, forms an excellent material for temporary work. When exposed to the weather, it cannot be depended upon to stand more than five or six years, unless kept properly painted, or otherwise protected; and when employed in the construction of houses it is extremely liable to rot if in contact with warm damp atmosphere."

Some of the foregoing remarks are diametrically opposite to my own experience relative to the durability of spruce timber for various purposes; and I consider that such remarks expressed by a gentleman of Mr. Smith's position and experience are apt to bring spruce timber into disrepute.

Thirty-two years ago an extensive farm steading was to be built upon this estate, and it was then determined that the roofing of the byres and stables was to be of spruce, being considered the best kind of roofing to resist the hot damp atmosphere arising from the breath of cattle and horses.

I supplied the spruce roofing from sound timber perfectly free from rot. Yesterday I examined carefully and minutely the state of the roofing. The byre is generally occupied with from forty to forty-five milch cows, and the stable with eight horses.

I found the roofing of these as fresh and hard as possible, and judging from present appearance they may stand good till they arrive at a hundred years of age.

It is a well-known fact over my employer's estates, that spruce timber is admirably adapted for roofing byres and stables.

From the tops of the spruce trees that supplied the roofing for the above steading I got bars cut for erecting an upright paling around

my garden. The posts and horizontal rails were of sound larch, and the upright bars were of spruce. This upright paling with little repairs stood proof against hares and rabbits for twenty-one years.

I have also used spruce piles in river embankments, where under the surface of the embankment they were constantly in moisture.

After being twenty years in use, a heavy flood washed away part of the embankments and laid the piles bare to within eighteen inches of their points, and to my agreeable astonishment the piles were as entire below the surface as they were the day they were put in, only the timber was very blue.

I could enumerate many other purposes for which spruce timber is admirably adapted, as well as for the foregoing purposes.

[We shall be pleased to receive further communications on this important subject, the Uses of Home-grown Timber, from our esteemed contributor, and others.—Ed. J. F.]

Ornamental Planting: Pampas Grass, Arundo Conspicua and Donax.

THIS being the best season for the planting of the above ornamental plants, a few words in their favour may prove interesting. The pampas grass is perhaps the most useful and effective plant for introducing extensively in wild coverts, with the twofold object of game cover and ornament; it succeeds well here (Longleat), and gives a highly ornamental aspect to the woods in autumn, when but few flowering plants are visible, lightening up as it does and contrasting beautifully with dark evergreens. To give the greatest effect they should be planted in groups of three, five, or more plants in proportion to the surrounding space; single specimens may be planted in suitable nooks where the space is more limited; choice plants with distinct and uncommon habit of plumes should be selected for these latter positions; the upright silvery one is to my thinking the best and most striking variety, and one which retains its beauty for a much longer period than any other. The rose and claret-coloured pampas grasses are the handsomest and most showy forms with drooping habit, but unless the stems of those latter are supported by means of stakes and string, they are almost certain to get broken down by strong winds before the whole of the beautiful panicles are fully developed. Sites sheltered from prevailing and cutting winds should be selected in front of evergreen shrubs, or backed up by sombre foliaged trees, but at the same time a light and airy situation with a rich soil and porous subsoil is the one they succeed best in. After the selection of the places for the plants or groups, the ground should be turned up to a depth of fifteen to eighteen inches, and a cart-load of rich soil, road parings, or loamy turf should be allowed to each plant, and well stirred in amongst the original soil; a thick mulching of manure should also be spread on the surface after planting, and if the weather be dry a thorough soaking of water will be necessary; pampas grass is benefited by being planted on slightly raised mounds, and shows off to better advantage than when placed on a level with the surface. Strong well-established plants treated as above are almost certain to succeed. If ground game abound wire netting should be fixed round to protect the young plants for a year or two after planting, for when the pampas grass is thoroughly established these mis-

chievous animals rarely do them any injury; but, on the other hand if small weakly plants be put out in the coverts, and the plants not sufficiently protected at first, they are almost certain to prove disappointing to the planter, either through hares and rabbits devouring them, or through want of sufficient soil in which to grow vigorously in and develop strong flower spikes; pampas grass requires gross feeding, and the richer the soil the stronger and more numerous will be the flower spikes produced. Even after the plants have been established in their permanent quarters they will derive great benefit from a covering of leaf mould or other enriching material being spread over the surface around each plant every autumn.

Arundo conspicua, another fine ornamental plant, though not quite so hardy as the pampas grass, and scarcely so vigorous a grower, but none the less graceful on that account. It has one advantage over the latter by coming into bloom a month or two earlier, and in consequence its graceful inflorescence is not so liable to be destroyed by rough winds and wet weather; while unfortunately the pampas grass does not open its flowers until bad weather has generally begun. In the southern and western counties *Arundo conspicua* stands the winters without protection, but further north it is not likely to succeed so well unless some protecting material be used to ward off severe frosts.

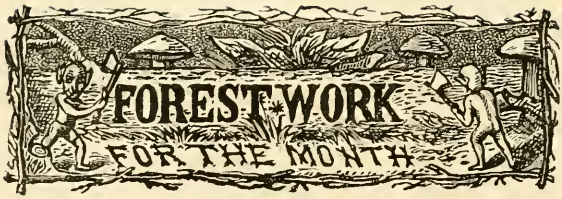
Arundo donax.—This is a very desirable tall-growing reed, giving a striking effect when associated with a pond or stream of water; it also shows off to great advantage in pleasure-grounds amongst low-growing shrubs. A variegated form of this can be had of a still more ornamental character; it is, however, not so hardy and is less vigorous in growth. The above Arundos should receive the same treatment when planting as the pampas grass; a little more protection will be necessary to keep them alive during very severe winters, especially in the northern counties, or in low-lying damp situations; a rich soil and a porous subsoil on a dry and slightly raised site is the most suitable position to ensure healthy and strong plants able to withstand severe frosts. G. B.

Aliceholt and Woolmer Forest.

The forest of Aliceholt and Woolmer is situated in the east part of the county of Hants, on the borders of the counties of Surrey and Sussex, and is bounded on one side by the river Wey, which becomes navigable at Godalming, about ten miles from the middle of the forest, and communicates with the river Thames, affording an easy conveyance of the forest timber to the dockyards in that river. The most ancient perambulation of this forest recorded is dated in the 28th year of Edward I., from which document it appears that this was one of the forests enlarged by the four preceding kings, and reduced by Edward to its more ancient limits. Another perambulation was made in the 11th of Charles I., and the boundaries of both appear to be the same. In 1787 the whole of the forest consisted of about 15,493 acres, but of that quantity about 6,799 acres belonged to private proprietors, and the rest to the Crown. The forest consists of two divisions, the one called the Holt, or Aliceholt, and the other Woolmer. The two parts are separated from each other by considerable extent of intervening private property. Aliceholt was formerly divided into three bailiwicks or walks, called the North, South, and West Bailiwicks, but this distinction has long been laid aside; Woolmer is divided into two walks called Linchborough Walk and Borden Walk. As is usual with English forests, there appear to have been disputes concerning perquisites, and the advocates of women's rights will not be displeased that a grant was made to a Mrs. Howe, of the Rangership of Aliceholt Forest, for a term of forty-five years commencing 15th December, 1699. Certainly she ought to have known something about the duties, as her deceased husband officiated when in the flesh as lieutenant of the same. But not content with one-seventh part of the produce of a sale in 1729, of 1,170 "dotaræ" and decayed trees, which were sold by the Surveyor-General for £980 (her receipt from such sale being £140), Mrs. Ruperta Howe claimed a right to the lop, top, and bark. With respect to this transaction the Commissioners appointed to inquire into the state and condition of the Crown forests, and whose report is dated 25th of January, 1787, remark, "This claim having been thus once admitted, it appears to have been made in one shape or other at every sale since." In the accounts of the next sales in 1732 and in 1737-8, the

price of the trees only is accounted for to the Crown, clear of the lops, tops, and offal wood of the said trees, the same being claimed by the said Mrs. Ruperta Howe by virtue of her grant of the office of ranger of the said forest, and her successors continued in her footsteps. But it is too wearisome to pursue the subject further, as it is merely the very old history of incompetent persons doing their best to fill their pockets at the national expense. To read the history of it, one wonders how even a fagot of firewood was ever devoted to the service of the country. During the eighteenth century no timber had been cut in this forest prior to 1777 for the use of the Royal Navy, probably owing to the trees not having till about that time grown to the necessary size. A fall of 300 loads of oak was then ordered by warrant from the Treasury for the use of the navy, and delivered at the usual price allowed for oak timber furnished to the dockyards from other of the royal forests, being 38s. per load. It was argued at the time, that if the timber had been put up for sale it would have realized nearly £2,500, whereas, at the arbitrary price of 38s. it only produced £1,074 10s. 9d., to which was to be added about £80 for stackwood, taken away by the people of Frensham under a pretended right, and out of which was to be deducted £179 19s. 9½d. for the expenses of cutting, &c., charged in the surveyor's account. In this case again it was a lady, Lady Hillsborough, who was lieutenant of the forest, and bewailed the loss of perquisites she was undergoing by the timber being used in the national service. It is, however, cheering to know that she gained nothing by her complaint. The Frensham folk, however, appear to have been the De Morgans of the day, for in 1788 another fall of 500 loads was ordered, and it being also ordered that the entire fall, including offal wood, should be sold by public auction, they openly carried the latter off, to the number of 6,365 fagots in one day and night. The Royal Commissioners observe, "In case the lieutenant should establish a right to the boughs and branches of all trees felled in the forest, we apprehend it to be extremely necessary that it should be determined what parts of a timber tree are comprehended under that description. It is well known that in navy timber, some of the most valuable pieces, as knees, crooks, &c., are taken from the limbs or branches of trees, and that other parts of the branches frequently contain timber fit for carpentry uses. It sometimes happens, also, that trees apparently fit for the navy prove unfit for that use, from some defect not discoverable while they are standing; which trees, nevertheless, contain good building timber, and large butts of trees and other pieces of timber are frequently cut off as unfit for the navy, but which are very useful for other purposes. So that if the lieutenant were allowed to take all that is not fit for the use of the navy, as was

done in the fall of 1,000 loads in 1784, he would, upon every fall made for the navy, have considerable quantities of useful timber which could not be comprised under the description of boughs and branches. It is equally necessary," continue the Commissioners, "that this point should be settled before any farther wood sales are made in this forest, as few persons would choose to become purchasers subject to such a claim, before it is determined what part they would be obliged to leave for the grantee." To us it seems that the meaning of the clause relative to boughs and branches could only be to give such boughs and branches as might be left, after taking out all that could be useful for house or shipbuilding. In 1608 there were growing in this forest 13,031 trees fit for the navy, and so many dotard or decayed trees as were computed to contain 23,934 loads. In 1635 the timber was valued at £10,247, reckoning the value at 10s. per load, underwood and thorns included. In 1783 the total number of oak trees was 38,919, measuring 15,142 loads, and 6,119 saplings of one and two feet each, besides beech, ash, and elm timber, valued altogether at £45,862 8s. 9d. These were days when it was an important matter to have a good supply of native oak for naval purposes; now, like other British forests, old associations make its principal value, although it still supplies good timber, and will doubtless continue to do so for long years to come.



The cutting of all deciduous hedges, thorn, privet, beech, hornbeam, &c., should be finished without delay, if not already done, so as not to interfere with or check the growth of young shoots which nourish the plants and form such a charming and interesting sight during the spring months.

The trimming of box, holly, and other evergreen hedges should now be proceeded with, as any frost that may occur after this is not likely to whiten the cut leaves.

Oak peeling will be commenced all over the country this month, and no time should be lost in finding out when the trees are ready for stripping. It often happens that some trees are earlier than others, but it is better to wait until the trees as a whole are ready, rather than waste time in wandering from place to place.

The forester should walk over the ground and find out the most suitable places for drying. The drying stands or stools should be constructed not only to throw the rain off, but also be arranged so as to have the ends of the bark facing the prevailing wind, thereby insuring a current of air through the mass. The drying process is very much accelerated by keeping the heavy bark by itself, either on a stool, or standing endwise on the ground in clumps of a dozen pieces, all leaning to the centre. The bark mallets and chisels should be all carefully numbered, so that when they are given out the numbers may be entered in a book kept for the purpose, against the name of the person using them, who is held responsible for them. Unless this precaution is taken there will be numberless losses and consequent delay of the work.

It is of the utmost importance that the forester should arrange his force to the best advantage, as the time is precious, and the most should be made of it; the best way of accomplishing this is to adjust the various parties in such a manner, that when they are told off to their respective duties they can do their work expeditiously and without interfering with each other. In all probability this will be the chief business of the month, and we would invite a discussion in these columns as to the best method of peeling oak, whether by day's

wages, or by piece work; also the most expeditious and certain way of drying bark, as well as its after management till it is sold or delivered to the tanner or bark merchant.

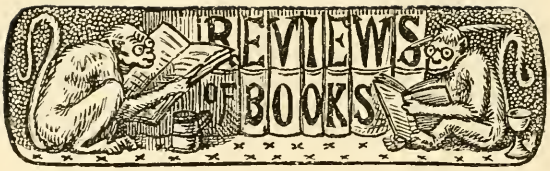
The pruning of all deciduous trees and shrubs ought to have been finished early last month at latest, and the pruning of evergreens should be completed as early as possible in this month, as it is not advisable to cut them hard-in after they have begun to grow freely. The cutting-in, or pruning, of evergreens should always be done neatly, and close to the base of a leaf or bud, the cut stopping down from it. See that alldr ains and watercourses are cleared of any obstructive material which may have been deposited in them during the winter months, and look to the putting in order of all fences, of whatever kind, before stock are turned into the pastures. See also that the gates of fields and plantations are in proper order, with the fastenings all complete, as nothing destroys a gate sooner than to allow it to be swung about by the wind, or, if badly hung, the head scraping the ground every time the gate requires to be opened.

Pay particular attention to all recently planted specimen trees, and see that they are securely staked to prevent them being swagged by the wind. If the weather is hot and dry do not allow them to suffer from want of water. A timely watering is the saving of many a valuable specimen, and should never be omitted if plants are expected to thrive and grow quickly into fine specimens.

Look over all recently planted young trees in plantations, and see that they are all firmly secured in the soil. If they have been "swagged" by the wind or the soil cracked by drought, a firm stamp of the foot will make all right, and save many trees that would otherwise die off if not attended to.

In the nursery the sowing of all pine, larch, and fir seeds should be completed before the middle of the month. Look over the previously grafted forest trees and repair the clay on the grafts, where it has cracked or dropped off, as the complete exclusion of the air tends greatly to the success of grafting.

Low grafted trees are better to have the soil drawn up over the clay on the graft, leaving only the scion exposed. Weed seed beds, and wage a determined war against all weeds, keeping the hoes going amongst them, and never allowing them to get into a flowering state. One dry day at this season is better for killing weeds than a whole week later on, when they have got into a flowering and seeding state; and many weeds run so quickly to seed that not a day should be lost in destroying them after they have made their appearance.



The Schools of Forestry; a Plea for the Creation of a School of Forestry in Connection with the Arboretum at Edinburgh. By JOHN CROUMBIE BROWN, LL.D., F.R.S., F.R.G.S., &c. Edinburgh, Oliver and Boyd.

In this interesting pamphlet of 72 pages, which Dr. Brown has addressed to the Right. Hon. Lord Provost, Magistrates, and Town Councillors of Edinburgh; the office-bearers of the Scottish Arboricultural Society; and all others whom it may concern, much valuable information is given upon the number, extent, equipment, and history of the Forest Schools in Europe, and the ample means possessed by them for thoroughly teaching the science and practice of forestry suited to the wants of the country in which the school is situated. The author possesses an extensive knowledge and experience of the state of forestry in several widely separated parts of the world, and has long taken a special interest in all that concerns the advancement and teaching of forest science and forest economy, having visited America, and traversed the greater part of the continent of Europe, visiting many of its most famous Forest Schools, in pursuit of correct information and details on the subject; all these he has embodied in the pamphlet which he has now laid before "all whom it may concern," giving very cogent reasons and most conclusive arguments why the country should immediately institute a School of Forestry, and forcibly pointing out the very great advantages possessed by Edinburgh, with its famous University, Botanic Gardens, and Arboretum, for the speedy and economical creation of a completely equipped and thoroughly efficient School of Forestry.

He says,—

"In Spain, in Italy, in Austria, in Poland, in Russia, in Finland, in Sweden, in France, and in every kingdom and principality in Germany, there have been established by Government Schools of Forest Science, or classes in connection with existing universities, or Polytechnic Institutions, in which instruction is given in that science; but nowhere in Britain, in the United States of America, or in any of the British colonies, so far as is known to me, are similar facilities afforded for the study of this most important science."

He then proceeds to give the opinion of the eminent Professor of Materia Medica, Edinburgh, and learned arborist, Sir Robert Christison, Bart., who says that he has always taken a great interest in the science of arboriculture, and from the time that the Edinburgh arboretum was first mooted, he has regarded it as a much-needed and valuable addition to the teaching power of the university. The science of forestry, he pointed out, was not taught in this country, and the consequence was that foresters and others had to proceed to the Continent in order to acquire that necessary branch of their education, so as to properly qualify them-

selves for holding the high appointments in their profession, either at home, in India, or the colonies.

Writing on this subject, Dr. Hooker, Director of the Royal Botanic Gardens, Kew, remarks,—

"Forestry, a subject so utterly neglected in this country that we are forced to send all candidates for forest appointments in India to France or Germany for instruction both in theory and practice, holds on the Continent an honourable, and even a distinguished place among the branches of a liberal education. In the estimation of an average Briton, forests are of infinitely less importance than the game they shelter, and it is not long since the wanton destruction of a fine young tree was considered a venial offence compared with the snaring of a pheasant or rabbit. Wherever the English rule extends, with the single exception of India, the same apathy, or at least inaction, prevails. In South Africa, according to the colonial botanists' report, millions of acres have been made desert, and more are being made desert annually, through the destruction of the indigenous forests; in Demerara the useful timber trees have all been removed from accessible regions, and no care or thought is given to planting others; from Trinidad we have the same story; in New Zealand there is not now a good Kauri pine to be found near the coast, and I believe that the annals of every English colony would repeat the tale of wilful, wanton waste and improvidence. On the other hand, in France, Prussia, Switzerland, Austria, and Russia, the forests and waste lands are the subjects of devoted attention on the part of the Government, and colleges, provided with a complete staff of accomplished professors, train youths of respectable parentage and good education to the duties of state forestry."

Dr. Brown then goes on to say that—

"Since my return to Europe, some ten years ago, from the Cape of Good Hope, where I held the appointments of Colonial Botanist and Professor of Botany in the South African College, I have, with the exception of a brief period, been in constant communication, personal and epistolary, with professors and students of Forest Science, and officials entrusted with the management or administration of forests in Britain, on the continent of Europe, in the United States of America, in the British colonies, and in India, having in the course of that time visited the United States a second time, and travelled extensively in France, Bavaria, Austria, Russia, Finland, Prussia, and Belgium, to obtain, and to verify information otherwise obtained, in regard to forest economy and forest science. And I submit for your consideration the opinion that, with the acquisition of this arboretum, and with the existing arrangements for study in the University of Edinburgh, and in the Watt Institution and School of Arts, there are required only facilities for the study of what is known on the Continent as Forest Science to enable these institutions conjointly, or any one of them, to take a place amongst the most completely equipped Schools of Forestry in Europe, and to undertake the training of foresters for the discharge of such duties as are now required of them in India, in our colonies, and at home."

From his acquaintance with the various systems and the courses of study followed at most of the Forest Schools on the Continent, Dr. Brown proposes what he considers a suitable curriculum for a British School of Forestry, and points out the advantages to eligible young men of not having to learn foreign languages, which in all probability would never be of the slightest use to them in after life, and the greater facility they would enjoy of thoroughly understanding the instructions given when imparted in their mother tongue.

In the course of study which is sketched to extend over three years, regard has been had to all that is required in Forest Schools, and also in regard to the present teaching power of the University and other institutions of Edinburgh, and it is contemplated that the studies should be conducted by the use of text-books, by lectures, by oral examinations, by

written exercises of various kinds, and by formal discussions by the students under the presidency of the teacher, and also by practical instructions in the various operations of forestry, conducted in the Arboretum, or in plantations or forests elsewhere within easy reach, by a thoroughly competent forester.

Such is a summary of Dr. Brown's proposals, and to illustrate the subject he gives many interesting particulars of what has been done elsewhere to establish and promote the study of arboriculture, from which we make the following extracts :—

The first systematic teacher of forest science and forest economy appears to have been Zanthiere, who did so at Ilsenburg, a town or village in the county Stolberg, in Upper Saxony, situated not far from the Hartz Mountains, and within the precincts of the old Thuringian Forest. Prussia was not long in perceiving the advantages likely to result from forest officials getting an education and training specially adapted to prepare them for the duties to which they might be called in the management of the forests, and a Forest School was established at Neustadt-Eberswalde, some thirty miles north from Berlin.

The Academy of Forestry is devoted to the training of Government forest officers, and of managers of forests belonging to private proprietors; it is confined exclusively to this, and no person can obtain an appointment to an office in the forest department of the Government without having undergone a strict examination in the several branches of knowledge required in the proper administration of forests, and without having served personally in the forests for a considerable length of time.

So great is the desire for Government service, and particularly forest service, in Prussia, and indeed in Germany generally, that there is no lack of students, although for the first ten years the remuneration is scarcely sufficient for bare existence, and may for years after that only pay for the necessaries of life.

According to one of my correspondents, a few years ago there were no fewer than thirty-three barons or baronets holding appointments in the Crown Forests of Prussia.

The forest School of Saxony is at Tharandt, a watering-place a few miles distant from Dresden, beautifully situated at the junction of three valleys, from two of which flow streams which unite and flow through the Planschengrund into the Elbe. The forest garden, containing, it is said, 1,000 different species of trees and shrubs, is attached to the School.

This Forest School was founded by Cotta, whose name, with that of Hartig, is identified with what is known in Germany as the *Fachwerke Methode* of forest management, and in France as the *Methode des Compartements*, which is the most advanced, in its accordance with forest science, of the various methods of exploitation applied to coppice woods and timber forests.

Cotta held the combined employment of chief of the *Institute de Amenagements*, entrusted with the management of the Crown Forests of Saxony, and of Director of the School of Forestry, which was founded by him in 1810. The Institute consisted of a number of commissioners who in summer carried on operations in the different forests, under instruction from him as their chief; and in winter reassembled at his residence, there to conduct under his direction the work of Forest-Bureau and prepare plans of operation for the summer following.

In Hanover there is an organized Forest Service consisting of 1 forest director—20 forest masters, who each have charge of a division and together with the forest director form a board of management—112 chief foresters—403 foresters—and 343 overseers and under foresters, who watch and protect the forests, and supervise work done by hire or contract; and, to provide for this service Forest Academies, at which the officials are educated and trained : one of these is at Munden, situated at the confluence of the Werra and the Fulda, whose united waters here take the name of Weser.

The Forest School of Hesse-Darmstadt is at Giesson, the chief town of Upper Hesse, beautifully situated on the Lahire, and is attached to the University, well known to students of agricultural chemistry as that in which Liebig laboured so long and so successfully as Professor of Chemistry.

The Forest School of the Grand Duchy of Baden is at Karlsruhe, where it it combined with a college of Engineers and a Polytechnic Institution.

The Wirtemberg Forest Academy is combined with an agricultural college at Hohenheim not far from Tubingen.

The Forest School of Bavaria, which enjoys a well-merited celebrity, is at Asschaffensburg, between Frankfort and Wurtzburg. Preparatory to entering this, students must have passed through the gymnasium satisfactorily, and must, with the sanction of Government, have passed through a preliminary instruction of eight months, extending from September to May, under a revier, or district forester, approved and appointed by Government. They must not be above 23 years of age, and they must possess means of support throughout the period required for attendance at the forest school. Students on finishing the curriculum at Asschaffensburg either enter on further practical training in the forest or in the forest office, or on attendance at a course of lectures on State Economics at the University; and they afterwards receive appointments to Government employment in the order of the excellence of the testimonials they have obtained.

The College staff consists of a Director, who, together with the first professor of Forest Science, has the rank of a Government and Circuit Forest Councillor, and four other professors with the rank of forest masters, and a revier forester, who acts as lecturer and as actuary clerk.

The direction and the control of the School is vested in the Minister of Finance and the Church and School Department of the Bureau of the Minister of the Interior, and in subordination to them is the Director of the School.

In Austria there are numerous schools, academies, and colleges established for supplying instruction and training in all that relates theoretically and practically to the development of the agriculture and horticulture of the country, and of manufactures connected with these; and with these there are three grades of Schools of Forestry, *Niedere Forst Schulen*, or Primary Forest Schools; *Mittlee Forst Schulen*, or Middle Class Forest Schools; and the *Forst Hoch Schule*, or High School of Forestry.

In 1858 Baron von Berg, Ober-forst-rath in Saxony, was applied to professionally to examine and report on the state of the forests, and the forest management in Finland; and he was thereafter applied to do the same in Poland. In this country, Poland, at Nova Alexandria, there has been established an important School of Agriculture, ranking with the universities of the empire. It was founded with a view to prepare agriculturists and foresters for carrying on their respective operations in accordance with the discoveries of modern science. There are two divisions, one relating to agriculture, the other to forest economy. The course of study extends over three years. Students must have passed through a gymnasium, or some corresponding public school. The fee charged is 50 roubles per annum. And they obtain, after passing satisfactorily the required examination at the close of the course, a diploma, giving them rank as agriculturists or as foresters.

From Poland we naturally pass into Russia.

In the *Ustaff Laesnoi*, or Forest Code of Russia, I found numerous details given of provision for the instruction of all employed in the management of the Crown forests.

In a report by M. Wereka, issued by the Ministry of the Imperial domains, it is stated that for the training of young men for carrying out forest operations in the service of the Government, or of private proprietors, there exist two special schools for superior instruction: the Agricultural and Forest Institute at St. Petersburg, and the Agricultural and Forest Academy of Petrowski, at Moscow. In these two establishments the course of studies extends over three or four years; and the students, having completed the course, leave with the rank of Practical Student or Candidate. For the training of the students in the practice of forestry, there are adjoining the academy of Petrowski two forests, one of 267 hectares and another of 73 hectares. Students at the Institute at St. Petersburg exercise themselves in practical work in the forest of Lissino, distant about 70 versts from St. Petersburg, and containing 30,000 hectares of forest, or 75,000 acres.

Besides these two establishments, there is also in the Government of St. Petersburg, at the village of Lissino, adjoining the forest, a school of the second class, at which the course of study extends over three years, when those who have completed the course leave with the rank of Forest Conductors, and may receive appointments as forest assistants and as forest officers of the fourth class.

This is designed for the training of young men for the discharge of the duties of the inferior classes of forest officers, and for the training of foresters to be employed by private proprietors. Pupils are received from 15 to 20 years of age.

The Agricultural and Forest Academy at Petrowski, near Moscow, was established on its present basis some years ago. On the 1st of June, 1872, there were 333 students in attendance. Amongst students who had completed their studies there, within the brief period of its existence, 16 had taken the degree of *Candidat*, which is considered to correspond to the university degrees of Master of Arts; of these, 3 were students of agriculture, 13 students of forest economy.

Besides these three principal Schools of Forestry and of Agriculture, and others in Moscow, in the Government of Viatcha, in the Government of Mogelhoff, at Gorka, at Cazan, at Cherkoff, and at Saratoff, where young men are trained to act as agriculturists and as managers of estates—there are minor Forest Schools in different parts of Russia, in which in some cases special attention is given to what may be considered special requirements of the districts in which they are situated.

In regard to the Steppe Forest School at Beliko-Anadolsk, it is stated, amongst many other things, that the students are to give their attention to the planting of the steppes with trees; the acclimatisation of several kinds of trees which are named; scientific meteorological observations, with the bearing of the facts observed upon the climatal conditions of life; observations on the growth of trees under certain conditions of climate; and on the effect of the growth of trees on the steppe on the climate of the locality.

The Central Forest Department is to provide them with forest seeds; and from certain institutions, subject to the Ministry of Imperial domains, charged with the culture and collection of seeds, they are also to receive seeds free of charge.

I have had occasion to mention, that in 1858 Baron von Berg, Ober-forstrath in Saxony, was applied to professionally to examine and report on the state of the forests and the forest managements of Finland. He did so; and amongst other results was this:—

For the instruction of candidates for employment in the forest service, there was established by decree, dated 10th March, 1859, a forest school at the Crown Park of Evois, in Lampes-socken, in Tavastehus-län, in which they might be thoroughly instructed in all that relates to the theory and practice of forest economy. It was opened on the 15th April in the same year, fully organized, and placed under the superintendence and charge of a director, with three resident lecturers and one field instructor. Students desirous of enjoying the benefit of the institution were required to produce a university diploma, or a first-class certificate of the completion of the course of study at one or other of the civil gymnasiums of the country; and there was provided for them free instruction, with free quarters and fire wood.

In Sweden there was established, in 1828, a Forest Institute; and in 1860 it was decided to establish, also at the expense of the Government, Lower Forest Schools in different parts of the country, so as to provide in the former a higher course of instruction for the education of forest managers, and in the latter a more restricted course for the education of skilled foresters and planters.

The forest schools supported by the Government are located at the following places:—Tierps, Upsala county; Ombergs, Ostergötland county; Böda, Calmar county; Daniels-Lands, Christianstad county; Hunneberg, Elfsborg county; and Silbre, Western Norrland county. From the report of 1867 it appears that 21,850 pupils in the "folk-school," or common school, received instruction in horticulture and tree-planting; and the Government offers help to support

additional forest schools where local authorities take the initiatory steps to establish them.

The Royal Forest Institute in Stockholm is pleasantly situated on a rise of ground in a grove close to the bridge as one turns from the city to enter the deer park.

In Sweden it is the practice in every branch of the public service and department of instruction to allow money for the travelling expenses of persons sent abroad to obtain information; and sums varying from 500 rix-dollars to 1,200 rix-dollars are often granted for travelling in foreign countries on forest purposes.

It was in France that modern forest science received its first development: and much was thus accomplished in the course of the last century. The French revolution and consequent wars interrupted the progress of this science in France; but it then shot up rapidly in Germany in the hands of Hartig and Cotta, and under their teaching. And on the re-establishment of peace the study was resumed in France by Lorentz and Parade, who found worthy successors in MM. Nanquette, Clavé, Tassy, and others. What is sought, as is stated by M. Parade, is to secure a sustained production of timber, by the replacement by annual growth of what is annually removed, combined with a natural re-sowing of the ground, and a progressive, ever-advancing improvement of the forest.

With the introduction of the new treatment of forests, in accordance with the *methode des compartements*, it was seen that in order to carry out this thoroughly and efficiently it was necessary to have agents educated, instructed, and trained with a special view to the prosecution of the work; and in 1824 there was established at Nancy a school for the study of all that is connected with forest culture and forest economy, such as had then been established in various parts of Germany.

In 1827 there was promulgated by Charles X. a new forest code, *Le Code Forestier*, in which were embodied all provisions made by laws previously issued applicable to the newly introduced method of forest management, while what was not so applicable was either modified to meet the requirements of the new *régime*, or was abrogated and declared to be so. And this was followed by the promulgation in the same year of an *Ordonnance Reglementaire*, or *Ordonnance du Roi pour l'execution du Code Forestier*. And these, with a few subsequently ordained modifications of particular articles, constitute the existing Forest Law of France.

In this Code it is ordained, Sect. iii.—"40. There shall be, under the supervision of the Director-General of forests—(1) a Royal School designed to train candidates for employment as forest agents. And (2) Secondary Schools for the instruction of pupil guards.

"41. The instruction in the Royal School shall embrace natural history, in its relations to forests; mathematics, applied to measurement of solids and to the drawing of plans; legislation and jurisprudence, administrative and judicial, in forest matters; forest economy, in what concerns specially the culture, the management, and the exploitation of forests, and the production of trees proper for naval purposes; drawing; and the German language.

"42. The Minister of Finance shall appoint three professors, to be attached to the Royal Forest School, namely: a professor of natural history, a professor of mathematics, a professor of forest economy, legislation, and jurisprudence. The courses of instruction shall last two years. They shall commence on the 1st November in each year, and close on the 1st September following. One of the three professors shall discharge the functions of Director of the school. A drawing master and a German master shall be attached to the Royal School.

"43. The Royal Forest School shall be established at Nancy. There shall be appropriated to this school—(1) a house to serve for lecture-rooms for the professors, the establishment of a library and a museum of natural history, and a dwelling for the director. (2) A piece of land for the nurseries and forest cultures requisite for the instruction of the pupils.

"By terms of the regulations for admission to the Forest School, approved by the Minister of Finance on the 24th February, 1864, the examination of the

candidates was to be on the following subjects, namely: (1) arithmetic in all its rules; (2) the elements of algebra; (3) elementary geometry; (4) applications of geometry; (5) rectilinear trigonometry; (6) elements of physics; (7) elements of chemistry; (8) elements of cosmography; (9) elements of mechanics; (10) elements of botany and vegetable physiology; (11) history of France, and geography; (12) drawing, mechanical drawing, and colouring; (13) the French language; (14) the elements of the German language.

"The trials consist of oral examinations and written exercises. The oral examinations are conducted by the examiners of candidates for the Polytechnic School. They are divided into two portions,—first degree examinations, and second degree examinations. The written exercises are executed in each Centre of Examinations, under the superintendence of forest agents designated by the Director-General.

"Instruction is given gratuitously to those who prepare for the State Forest service. But, according to the latest information in my possession, parents or guardians have to pay the following sums for board and lodging, the purchase of the uniform, and the requisite mathematical and other instruments:—

	Francs.
1. On entering the school, for uniform and instruments -	900
2. For board and lodging, attendance, and other ordinary expenses, at the rate of 1,500 francs per annum -	3,000
3. For pocket-money, not exceeding 600 francs per annum -	1,200
Total expense for two years	5,100, or £204.

"According to the official *Programme de l'enseignement de l'Ecole*, issued last year (1876) the course of study in connection with the school extends over three years; instruction being given during two years to pupils in accordance with the requirements of the code, and in a third year to advanced students designated *Les Gardes generaux stagiares*, or Licentiates.

"In Italy, shortly after the establishment of the present kingdom, a Central Forest School was organized in the vicinity of Florence. The Director is M. di Bérenger, who was formerly in the Austrian forest service of Venezir, and is well known by an excellent work on the history of forest management in Italy (*Archeologia Forestale ossia de'l antica Storia e Giurisprudenza Forestale in Italia.* Venezia, 1863.) The district assigned to the institution is the splendid silver fir forest of Vallombrosa, below the crest of the Apennines, on their western slope, about twenty miles east of Florence. During winter the school is transferred to a lower situation at Paterno, in the region of the Olive, half-way between Vallombrosa and the railway station of Pontassieve, in the valley of the Arno. For the use of the students a collection of excellent memoirs is being published by the director, with the assistance of some of the professors, the first volume of which has been completed, containing an introduction on the climatic and general influence of forests; a brief historical account of forest management in Germany, France, and Italy; two memoirs on the structure, nutrition, and cultivation of forest trees; and a paper on the valuation of forests and the preparation of working plans.

"I do not happen to possess any information in regard to the Forest School in Spain beyond the fact that there is such an institution; it is in the Escurial."

These extracts give a brief history of the rise and progress of Forest Schools in Europe, and show the great importance attached to the subject, and the praiseworthy efforts made by every progressive State on the Continent to promote and impart a thoroughly scientific and practical knowledge to foresters in every branch of their profession. It must be noted that all the Schools mentioned are Government institutions, and kept up in most cases solely by the State, under control and supervision similar to other State educational institutions.

After giving many interesting details of the order and method of teaching followed at the various Schools, he gives full particulars of the

"Regulations" published by the Secretary of State for India in 1867 and 1872, for the selection of candidates for nomination to junior appointments in the Forest Department in India, which are now pretty well known to those interested, but are much too long to quote here in full, and we may add that the crop of foresters they have produced does not appear to be over luxuriant, considering the immense interests at stake.

Referring to a difference of opinion between Professor Balfour, of Edinburgh, and Dr. Brandis, Inspector-General of Forests in India, up n the merits of home teaching versus Continental teaching of foresters for India, he says:—

"The remarks made by Dr. Brandis in regard to the requirements of forest conservation and extension in India are more or less applicable to the requirements of forest conservation and extension in the British colonies, and, I may add, in some of the states in America; but without entering on the alleged requirements of India, I consider, from what I do know, that the requirements of forest economy in many of our colonies might be met, in accordance with the reported views of Dr. Balfour: and great advantage to intelligent foresters who wish to give themselves to the management of forests in Britain, to the proprietors of such forests, and, through them, to the country at large, might be secured by the establishment of a lectureship on Forest Science in connection with the Edinburgh Arboretum.

"Not knowing of the desire of Sir Robert Christison to provide facilities for the study of forestry in connection with the University and the Arboretum, I have been endeavouring to meet this felt want; and in do ng so I have come to know that the desideratum has been felt by many others, including Governors of colonies, noblemen and gentlemen in Britain, the agents of landed proprietors, foresters and nurserymen, and men distinguished for their attainments in science and their endeavours to employ these in the advancement of the interests of man, as will afterwards be shown.

"Dr. James Brown, in his treatise on Forestry, laments that there is not a school in Great Britain where young men can learn efficiently all the branches of study in connection with forestry, and gives the following advice as to the way in which a self-supporting institution for that purpose might be established: 'Let an arboricultural association be formed of some of the leading landed proprietors in the country, with a few men of science among them, having for their object the cultivation of trees on the most approved and improved principles of the age, and the training up of young men as foresters according to these principles, in order to fill the places of the existing foresters of the old school, and thus as early as possible bring about an improved state of arboriculture for the general welfare of the country.'

I have been asked, 'How has it come to pass that so little has been done in Britain, while so much has been done on the continent of Europe to raise up a body of foresters, highly educated for the discharge of their duties? My answer must be, hitherto the problem to be solved in Britain did not require the amount of information which was required for the solution of the complicated problems demanding solution there. On the Continent they were threatened in many quarters with a lack of fuel, with a lack of timber, with ruinous desiccation, and with destructive torrents, all consequent on the destruction of their forests, and with the devastation of fertile lands by drifting sands, which could only be arrested and utilized by the planting of trees. In Britain we find fuel in our coal mines, and in many country districts in our peat bogs; excepting for a short time about the beginning of the present century, when war was raging, we could get timber of every description from beyond the sea; we know little of drought, of torrents, and of drift sands, and the difference has told upon our language. While our French neighbours speak of *Sylviculture*, the culture of woods, we speak of *Arboriculture*, the culture of trees. While they, in speaking of *Les forêts* and of *La Code Forestiere*, refer to a country covered more or less with trees, we, in speaking of *the greenwood* and of *forestry*, hitherto have thought chiefly of the game and of the chase, or of the shooting of deer. Our forest laws

relate mainly, if I may not say exclusively, to hunting, these laws having nothing to do with shrubs and trees, excepting in so far as they may supply shelter or covert for game. I speak advisedly when I say that, according to the technical use of the term in English law, a forest need not contain a single tree, and a dozen of contiguous counties might be covered with trees without these constituting a forest. The totally different circumstances in which the different countries have stood in regard to the requirements of forest products account for the difference in the attention hitherto given on the Continent and in Britain to the study of what is known there as Forest Science.

"It may be asked, seeing it is so, 'Why should we not go on as we have been doing hitherto?' The answer is given in the passage I have cited from Dr. Hooker. In our colonies, and in the Empire of India, evils which have long existed are being remedied; and those whom the country would engage to go forth to meet the evils must go, at the country's expense, to acquire the necessary education in other lands, and in a foreign language, unknown to most young gardeners and foresters, and sons of foresters, and which is so taught in many of our schools, that few even of the young men of our country who have had a liberal education could understand instruction given in it, as they could instruction given in their own tongue."

Forcibly contrasting the scanty amount of English forest literature with its abundance and richness in foreign languages, Dr. Brown goes on to give a summary of what has lately been done in India, Australia, and the United States for the promotion of forest science, and says:—

"These facts may be accepted as indications that it is becoming of importance that arrangements should now be made for instruction in forest science being communicated in English to those to whom may be entrusted the administration and management of forests, but who can only imperfectly avail themselves of the extensive arrangements for this being done in the other languages of Europe."

After giving the opinions of several eminent and skilled authorities upon the great want there is felt for a Forest School in Great Britain, he concludes with a strong and ably advocated appeal to "all whom it may concern," for the establishment of a Forest School in connection with the Arboretum, University, and other educational institutions in Edinburgh; upon which there may be some difference of opinion, but of the *necessity for a school* there can be none.

Landed Estates Management. By Robert Scott Burn. London: Crosby Lockwood and Co.

In this handy volume we are presented with a complete and comprehensive outline of the duties appertaining to the management of landed estates, and the various operations necessary to be performed under that department of rural industry; the whole being conveyed in such clear and concise language that the appearance of the book will be hailed as a great boon by the numerous and influential class interested in the profitable and judicious management of landed property, and who have not had up to the present time any really useful "handy" book treating upon their multifarious duties in a concise and intelligent way, and which they can conveniently carry in their pocket and refer to when going about in the performance of their duties.

The work opens with an interesting chapter on the local peculiarities and characteristics of landed property, and then goes on to give seasonable hints and much valuable information on the general features of the estate, fields, wood, water, lowlands, uplands, moss and heath lands, game laws, leases, and tenant right. The varieties of soils next receive due attention; the position and size of farms, large farms *versus* small farms, the "home" farm, different

kinds of farming, rotation of crops, live stock, capital necessary to farm profitably along with a thoroughly trained knowledge of husbandry, economy of properly laid-off fields and fences, the laying out and construction of farm roads, reclamation of waste land, the relation and duties to each other of the landlord, factor, overseer, tenant, and labourer ; leases and their advantages, the laying out and construction of estate roads and fences, selecting a site for the farm buildings, and their proper arrangement, illustrated with two excellent plans; designing of cottages and farmhouses, water supply, and the construction of ponds and reservoirs; enclosing lands from the sea, river embankments, different systems of irrigating land; plantations for shelter and timber, and the great importance of selecting the kinds of trees best suited to the soil, climate, &c. ; drainage and deep culture of the soil; farmyard manure and compost heaps ; lime and its uses in improving land, mixing of different soils to improve the staple, treatment of pasture lands, modes of reclaiming various kinds of lands and their after cultivation, thick and thin sowing of seeds, the great importance of good breeds of live stock and their proper treatment, and the improvement of exhausted or neglected property, which forms the theme of the concluding chapter, in which the author makes the following judicious remarks:—

"Where an estate has been allowed, through a variety of circumstances—some of which will at once suggest themselves to the reader—to be thoroughly worked out, and to have nearly all its departments in a condition the very reverse of well-managed property, it will be a fortunate circumstance for those who are afterwards to inherit it, by right of descent or by purchase, as the case may be, that 'something should happen' which will permit of its falling into the hands of those who will be inclined to do it justice, and have it brought up to the present standard of modern farming and estate management. Some of our readers new to the subject may be surprised to learn that in our country there should be any estates in the condition we have hinted at ; but to those whose duties take them amongst farms, &c., &c., the statement will be no new thing, nor will it create surprise ; indeed, a very eminent public personage, who knows the subject well, has stated that, taking the farms of Great Britain all round, by a higher style of cultivation and general management their productive powers could be increased fifty per cent. This, however, like such broad statements generally, must be taken with a reservation ; but its main principle is correct, and it will indicate to the student that, considering the large number of estates and home farms splendidly managed and cultivated, the number of those in the opposite category, with a hint at which we opened this section, must be very great.

"In commencing the work of improvement of an estate, the proprietor, if a wise man, will ascertain before taking any other steps how much money will be required to do justice to the improvement ; and if he finds that he has not sufficient to apply this to the whole area of the estate, he will act wisely in appropriating the amount he can spare to improving thoroughly a small part of it, instead of only half—or perhaps in less proportion than this—improving the whole. To nothing is the axiom, 'If a thing is worth doing at all, it is worth doing thoroughly well,' so applicable as to the soil,—an axiom too often forgotten by both proprietors and farmers, and which largely accounts for that deterioration of estates now under consideration."

Such is an epitome of this useful and handy treatise, giving needful hints and suggestions to landlords, estate managers, tenants, labourers, and others whose duties are in any way connected with the management and working of landed property, and for whose special benefit and ready reference it is remarkably well adapted.

Transactions of the Scottish Arboricultural Society. Vol. VIII. Part II. Edited by the Secretary, JOHN SADLER, F.R.P.S.E. Edinburgh: Printed for the Society by M'Farlane and Erskine.

The annual instalment of the Transactions of this industrious and most useful institution, the only "arboricultural" society in Great Britain, contains a number of valuable contributions to the scientific and practical literature of forestry, which will be read with the greatest interest by all who have watched the progress of the society from a humble beginning on the 16th of February, 1854, to its present prominent and flourishing position. For some years after its commencement the whole of the Society's yearly Transactions were easily contained in a few pages; but the present volume extends to over 200 pages of most interesting and instructive matter, embracing essays and reports on a wide range of topics, from the anatomical structure of the leaf of an Abies to the best method of seasoning timber.

The first paper in this part is a carefully worked out, and very interesting essay "On the Anatomical Structure of the Leaf, as a means of determining the species of Abies," by Dr. W. R. McNab, Professor of Botany, Royal College of Science, Dublin, who gives a concise and lucid description of the structure of the leaves of 23 species of Abies, and 5 species of *Pseudolsuga* (Carrière), illustrated by an excellent plate of sections of twelve of the species described, showing the distinctive features of each by the position and form of its characteristic parts, viz., the central sheath of fibro-vascular bundles, resin canals, hypoderma, epidermis, and stomata. The article will well repay perusal by all foresters as well as botanists; but it is to be wished that hard scientific names could be avoided as much as possible in such an article, for the sake of those members of the Society who have not had the benefit of a classical education, and probably do not possess even a good botanical dictionary.

"On the Timber Supply of Australia." By the Hon. Mr. Kirchauff, Member of the Legislative Assembly of South Australia; with a Note by Robert Hutchison, Esq., of Carlowrie, V.P.S.A. Soc. In this valuable and comprehensive paper upon the present state and prospects of the forests and timber supply of Australia, Mr. Kirchauff enters into many interesting details, some of which we hope to be able to place before our readers in a future number, but at present we need only quote Mr. Hutchison's opinion of it, than whom few can speak with better authority on the subject. He says, "The following deeply interesting and instructive paper was recently read before a meeting of the Chamber of Manufacturers, in the South Australian Institute, Adelaide, under the presidency of his Excellency the Governor of South Australia. As much of the ground so ably traversed in his address is very suggestive, and at the same time instructive to the practical forester of our own country, and to the younger members of the Scottish Arboricultural Society, Mr. Kirchauff's paper is here reproduced, in the hope of showing the strenuous calls for forest conservancy and extension of plantation works which exist, and are being grappled with in some of the most important colonies of the British Crown. A perusal of the views of so able an advocate as Mr. Kirchauff may suggest reflections applicable to our own native land, and arouse arboriculturists to the fact that, if such conditions of necessity for forest conservancy exist in comparatively sparsely peopled and new countries, it is surely the more incumbent upon the practical labourer in the cause of arboriculture in the mother country to endeavour by all the means in his power to further the art of his profession, and to promote the

home growth of valuable timber, seeing so many of the old timber supplies in countries whence we have been accustomed to draw largely for our constructive wants at home, must now have yearly increasing demands upon their resources, in competition with our own, from those rapidly progressing colonies which Great Britain has established for her surplus population in all quarters of the world, even in climates where timber for constructive purposes is by no means abundant."

"On the Cheapest and most Effectual Means of Clearing Land for Planting." By D. T. McKenzie, Forester, Meldrum House, Aberdeenshire. Here we have a valuable practical paper, giving full details of an excellent method of clearing brushwood, furze, broom, &c., by a pair of oxen yoked to stout chains passed round clumps of the brushwood, &c., which is dragged clean out by the roots and left in a state easy for removal, enabling the ground to be cleared at a comparatively small cost, and in favourable cases even producing a profit from the sale of the brushwood and roots, for firewood or other purposes. We have then excellent instruction upon the clearing of rough herbage, and heather, by burning; and a strong recommendation in favour of the employment of steam power, as "the most speedy and most economical" system of extracting large tree roots; upon which there can be little difference of opinion. Dynamite is also spoken of and recommended as useful in bursting up very large roots, speedily rendering them easy to remove, but it is yet much too expensive an article for general use.

The next paper, "On the Diseases of the Larch," by the same author, treats of a subject which has been the cause of much anxiety to foresters, and heavy loss to many proprietors; but the exact nature of the causes which produce it are still much disputed amongst arborists and botanists; and we do not see that the present paper adds much to our knowledge of the subject, although some ideas are started which are worthy of further investigation.

In a "Report on Old and Remarkable Trees growing on the Estates of Bayham Abbey and Wilderness Park, in the County of Kent," by James Duff, Wood Manager, Bayham Abbey, many very interesting particulars are given of twenty-five grand old trees, including oak, ash, beech, Spanish chestnut, evergreen oak, and cedar of Lebanon, growing on those estates, the measurements and particulars of which will form a useful record to future generations, of the progress made by those giants of the forest, in centuries to come. This is a subject we would strongly recommend to the notice of all those who possess or have the care of old and remarkable trees, and hope they will do as the author of this paper has done, "make a note of them," and publish it.

A meritorious paper by the same author, "On the Arboriculture of the County of Kent," takes a cursory glance at the general arboricultural features of the "Garden of England," and gives valuable and interesting information upon the profitable cultivation of coppice for hop-poles, which are in great demand, and bring very remunerative prices in this hop-growing county.

"On the Deleterious Effects of Sulphur upon Iron Fencing," by Thomas Wilkie, Forester, Invergarry, Inverness-shire, gives a timely caution to all who may be erecting iron fences, against the use of sulphur for batting the fence into stones, because it corrodes and eats through the iron in a few years, rendering the fence worthless till the standards are renewed at great cost. He recommends "batting with lead as the best plan in all cases," as it does not injure the iron, and has stood for twenty years as

clean and sound as when first put up, the surface of the iron never having become broken or corroded.

In another paper from the same author "On Two New Modes of Fencing," a process is first described by which a "Pollard Fence" is formed, with pollard trees, larch stobs, wires, staples, and winders, which may be very picturesque, but in our opinion it will *not* "supersede any kind of fencing yet introduced;" although such an opinion is expressed by the author, and the fence said to combine "strength, durability, ornament, and invisibility." The second new mode, "The Willow Hedge," presents us with a neat design of an old pattern, but is not much of a fence against cattle or sheep, who would delight to browse upon and eat their way through it.

In a third article from the same prolific author, "On the Best Method of Seasoning Timber," we get some good suggestions, that by ringing standing timber a year before it is felled, it will thereby become seasoned and ready for use immediately after it is cut down, a theory that is already held, and to a limited extent worked upon in some parts of the country, but which wants to be much more extensively proved and tested by competent authorities before it can be recommended as the best method of seasoning timber; and we fail to see how the process will ever increase the value of the timber to the owner by over 30 per cent., as calculated in the paper before us.

A committee of the Society having been appointed to superintend a grant from the British Association, for the prosecution of an inquiry into the influence of forests on climate, and ultimately in reference to the influence of forests on rainfall, a series of interesting and carefully conducted experiments have been carried on for some time at Carnwath, in Lanarkshire, upon which Mr. Buchan, M.A., F.R.S.E., has made a most interesting and valuable report, which we hope to see continued yearly till the problems involved are thoroughly investigated and satisfactorily solved, as the subject is of the deepest interest to this country and its dependencies, and could not possibly be in better hands than those of such an eminent scientific meteorologist as the Secretary to the Scottish Meteorological Society.

Of the remaining two papers, "On Insects Injurious to Forest Trees, and their Destruction," by Malcolm Dunn, Palace Gardens, Dalkeith; and last, but by no means least, a "Brief Account of the Royal Forest School at Vallombrosa," Italy, by Hugh Cleghorn, M.D., of Stravithie, St. Andrew's, we need only say that they will well repay a perusal by all who are interested in arboriculture, both being upon subjects that are daily becoming of greater interest, and receiving increased attention in all civilized countries.

In conclusion, we would recommend all arborists, and those who are interested in trees or timber in any way, to become members of such a useful Society as the Scottish Arboricultural, not only to help on a good cause, but to enjoy the benefit to be derived from reading the "Transactions," which are good value for twice the amount of the annual subscription.

Through the courtesy of the secretary, Mr. Sadler, F.R.S.P.E., we are enabled on another page to lay before our readers a list of the subjects offered for competition during the present year, with the conditions of competition, and trust that many of them will make an effort to win at least one of the coveted medals, and add their quota to the still limited store of British arboricultural literature.

Familiar Wild Flowers. By F. Edward Hulme, F.L.S., F.S.A. Cassell, Petter, and Galpin, London and New York.

The first part of this beautifully got-up little work contains prettily coloured plates and interesting descriptions of the Field Convolvulus (*Convolvulus arvensis*), and the Field Rose (*Rosa arvensis*), two of the prettiest and most graceful of our wild flowers; which hold out good promise that the work will form, when complete, a useful and elegant book on "nature's loveliest gems," suitable either for the drawing-room table or the fireside of the cottager, and will fully meet the wants of a numerous class of lovers of our wild flowers, who have neither time nor inclination to wade through the dry technicalities of a complete scientific British Flora, but who will scan with pleasure and benefit the pages of this pleasant and entertaining addition to the literature of our native wild flowers. The plates and designs are drawn with considerable care, and the colouring nicely done, if not exactly true to nature, so that with the assistance of the plates and designs, and the technical descriptions given in a gossipy and easily understood style, amateur lovers of wild flowers will have no difficulty in finding the name and learning something of the history and uses of the beautiful flowers they meet with in their rambles over the hills and dales and through the flowery woods and lanes of the country.

Discovery of a New Conifer in Europe.

It inhabits the mountains of those "unhappy" countries, Servia, Bosnia, and Montenegro, and Dr. Paucie is the botanist who, after much consideration and research, and after taking the opinion of the late A. Braun, K. Koch, and others, has described it as a new species under the name of Pinus Omorika. It belongs to the Abies section, and is most nearly allied to P. orientalis. Omorika is the Servian name of this tree, which Dr. Paucie describes as being of gigantic stature, equalling if not exceeding, the loftiest of its European congeners. It is of slender habit, with relatively short branches forming a pyramidal crown; bark of the trunk brown-red, peeling off, the fragments often heaped up in great quantity around the base of the trunk. The lower branches pendent, with the extremities only directed upwards. Needles (leaves) of a silver-grey hue, small and short (about five lines long), usually obtuse; cones oval-oblong, two inches long, at first erect, gradually assuming a horizontal position, and finally pendent; when young of a beautiful violet colour, when mature reddisd brown, with an intermixture of ash-grey. Scales of a roundish shape, faintly striated, and unequally toothed in the upper part. The foregoing particulars are from a lengthy article by Carl Bolle in the Berlin Horticultural Society's *Journal*. Dr. Reichenbach contributes some notes on the same subject to the *Botanische Zeitung*, N.S., 1877, from which it appears this tree—"whether species, variety, or climatic form"—is known by the name Omorika from the Adriatic to the Danube; and it is supposed that it was formerly more widely dispersed than appears to be the case at present. This is founded on the assumption that, because the name is so widely understood, the tree yields a valuable timber. Grisebach regards it as a variety of P. orientalis, but whether distinct or not it is none the less interesting, and another illustration of the distribution of Coniferæ as exemplified by the Cedars, Pinus Peuce of Grisebach, &c. Both Reichenbach and Bolle had specimens before them, as well as a paper on the subject by Paucie himself.—*Gardener's Chronicle.*

A SCHOOL OF FORESTRY.

SIR,—I beg to submit to you a copy of a letter which I have this day addressed to the Magistrates of Edinburgh and others, the design of which is to show that, with existing arrangements for education in Edinburgh, there might at little additional expenditure be created in connection with the proposed arboretum in that city, a School of Forestry suitable for the training of foresters for the efficient discharge of such duties as are now required of them in India, in our colonies, and at home.

While Edinburgh offers facilities for this being done such as are presented by few places in the kingdom, it is by no means the only eligible place. In any of our university towns a School of Forestry might be located with advantage. Such institutions as the School of Arts in Edinburgh, and the Andersonian Institution in Glasgow, the Agricultural College at Cirencester, and the Scientific College established in Dublin by the Board of Trade, all supply educational arrangements for the study of natural science which might be made available for such a purpose.

There was a report in London last week that the City companies had in contemplation to establish in the metropolis or its neighbourhood a Technical University for the working classes. This may possibly supply similar advantages.

I have given detailed information in regard to the curriculum of study followed in Schools of Forestry on the continent of Europe, and detailed information in regard to a corresponding curriculum, which, with the addition of a Lectureship on Forestry to existing arrangements, might be followed here. The former may supply to some of your readers information desiderated by them in regard to what branches of study are deemed necessary for foresters on the Continent, and the latter may suggest how existing educational arrangements in Britain may be adapted to the requirements of a British School of Forestry.

I shall feel gratified if you will bring the subject before your readers; and if you do, I shall be happy to supply through your pages any additional information in my possession which may be desired by your correspondents.

I am, Sir, respectfully yours,

JOHN C. BROWN.

Haddington, 12*th April*, 1877.

SUGGESTIONS.

SIR,—I am glad a gap long felt by every practical forester is now to be filled up, viz., the starting of a *Journal of Forestry and Estates Management.* A journal on arboriculture will act centripetally and centrifugally, concentrating and circulating views, opinions, and suggestions, affording each forester an opportunity of comparing and contrasting his own personal ideas and experience with those of others. Forestry has long been looked upon as a mere mechanical art, requiring no other training than is necessary to be an expert at felling trees. Practical forestry is a science distinctly elevated above all that is fanciful, and may be defined as the art of producing the greatest quantity possible, of the most valuable kind of timber, on a given area of ground; or in other words, the science of utilizing the soil, and increasing its value under a crop of timber to a maximum point at a minimum expenditure.

Practical experience, no doubt, is an excellent teacher, but no man can from practice alone acquire that amount of knowledge he may possess in a short time by perusing the written opinions of others. However much may be our own personal knowledge, from others we can cull hints, which, if properly applied, will be found permanently useful. A competent forester is not to be found ready made; he must go through a course of instruction before he can appreciate the laws which govern vegetable productions, their generic qualities and growth. No better medium can be found than a journal on forestry. It will act as a gatherer, a snapper-up, and a recorder of many useful hints, and when generally known will be found an invaluable auxiliary to the practical arboriculturist.

The members of the Scottish Arboricultural Society are scattered far and wide by mountain, stream, and sea. They have no opportunity of expressing an opinion on any subject. Now, argument is accompanied with beneficial results when conducted openly through the press; it dispels delusions and prejudices, and fosters a desire after information. Much could be written on the benefits, practically and theoretically, which forestry will receive by the starting of this Journal, and the enterprise ought to receive the support of every forester, estate manager, and landowner in Great Britain.

In conclusion, permit me to suggest that the Journal must be comprehensive and exhaustive, including all matters connected with arboriculture and the management of landed estates, with the kindred subjects of agriculture, horticulture, geology, chemistry, botany, natural history, and occasional papers on other subjects, which will render the undertaking a complete success. The necessity for such subjects being treated in a Journal of Forestry will sufficiently suggest itself.—I am, sir, yours faithfully,

DAVID SYM SCOTT,
Forester.

Baltinacourt, Tipperary.
April 9, 1877.

ROMAN CEMENT FOR BATTING.

SIR,—In the last issue of the Transactions of the Scottish Arboricultural Society there is a report on the deleterious effects of sulphur upon iron fencing. A better material for batting iron into stone than either sulphur or lead is what is called here Roman cement. The stone of which it is made is found

in the sea cliff; it lies on the top of the alum rock, is about six inches thick, of a light grey colour, and a great many fossils are found in it. It is burned as lime is burned, and then ground in a mill. When fresh and new ground it sets very quick, and will not bear any sand unless it be washed clear of all loamy substances. It is easy to apply it in batting. The cement is put into the hole before the bat—or standard, as the case may be,—the bat is inserted as quickly as possible, the cement neatly dressed round the bat, and the work is finished. There are doors of between two or three hundredweight on this estate, hung on crooks fixed with the cement, which are now as firm as when first hung ten years since. I have seen bats taken out of stones, and the surface of the iron was as sound as when it came out of the hands of the smith.

Portland cement is too long in setting to answer well for batting.

The price of Roman cement is 3s. per bushel. Fifteen bushels will weigh about one ton. ANDREW SLATER.

Rose Cottage, Loftus-in-Cleveland, 19th April, 1877.

AMERICAN PLANTING.

SIR,—The science of forestry as pursued in Europe is almost unknown in the United States, though a rapidly growing interest is being manifested. The railroad companies of the far West, to whom extensive grants of public lands have been made, are now largely interested in planting for wind-breaks or shelter, and for timber for fuel and railroad constructive purposes. Very few private individuals east of California are planting except experimentally. My firm probably have planted as great a breadth as any; having been planting seed of forest trees and seedlings in Virginia for the last six years. This spring we have planted 300 acres in black walnuts, and in a few years will complete some thousands of acres in hardwood nut-bearing trees. I may perhaps be able to interest your readers in the varieties of trees most likely to succeed in this country, and the most practical method of growing them. The variations of species, soil, and climate in many instances necessitate a course of treatment very different from that pursued in England.

Philadelphia, U.S.A., BURNET LANDRETH.
12th April, 1877.

OBITUARY.—We regret to have to announce the death of Mr. Thomas Dickson, of Chester, which occurred on the 23rd of March. The deceased gentleman was the youngest son of the late Mr. Francis Dickson, the founder of the well-known nursery firm of Francis and Arthur Dickson and Sons, of which Mr. Arthur Dickson is now the head.

Scottish Arboricultural Society.

The following is a list of the subjects offered for competition by this Society during the year 1877 :—

I. For a full and complete account, from published descriptions (with authorities distinctly quoted), personal observation and experiment, of the history and present state of the cultivation in Great Britain and Ireland of *Cedrus deodara* (*C. Libani*, and *C. Atlantica*, all now classed at Kew as one species). (Special Medal, value Three Guineas, offered by Dr. Cleghorn.)

II. For an approved Report on the most extensive, complete, and judiciously arranged Arboretum. (*A Medal.*)

The author must describe the positions as to soil, exposure, elevation, etc., of the respective species of varieties of trees reported on, and state their ages, treatment, cost, and mode of planting adopted.

III. For an approved Essay on the present state and future prospects of Arboriculture in the county in which the competitor resides. This is a standing subject. (*A Medal.*

IV. For an approved Report on the Old and Remarkable Trees on the estate on which the competitor resides; correct measurements of the circumference of the trunks, at 1 foot and 5 feet from the ground, must be given; also height of tree, spread of branches, etc. Photographs are desirable. (*A Medal.*)

V. For an approved Report on the Summer operations most beneficial to plantations and woodlands.

The Report to embrace such subjects as pruning, thinning, transplanting, draining, etc., with special reference to the effects produced by them while the trees are in full growth and leaf, compared with similar operations performed while nature is dormant. (*A Medal.*)

VI. For an approved Report on Plantation Enclosures of any New Construction, and their management, cost, and durability for various situations.

The Reporter will detail the various modes of protecting plantations, their comparative costs and expense of maintenance, whether live fences, palings, or walls. (*A Medal.*)

VII. For the best and approved collection of Cones, ripened in Britain during 1875, 1876, and 1877. (*A Medal.*)

Each cone (or series of cones of one species) must be accompanied by a label giving the name of the species, the estate and county where produced, and the year grown. The prize collection to become the property of the Society.

VIII. For the best and approved collection of Seeds of Forest Trees and Shrubs ripened in Britain. (*A Medal.*)

Each example of seeds to have a label, giving the name of the species, and where produced. The Prize collection to become the property of the Society.

IX. For the best and approved collection of prepared sections of different kinds of Wood grown in the county in which the competitor resides (*A Medal.*)

Each section must have a label attached, bearing the name of the wood, the estate and county where grown. The Prize collection to become the property of the Society.

X. For the best and approved series of Geological Specimens illustrating the different rocks and formations on which Forest Trees and Shrubs grow in the county in which the competitor resides. The specimens to be accompanied by a Report. (*A Medal.*)

The successful collection to be the property of the Society. Buteshire, having already been reported on, is excluded.

XI. For an approved Report on the Plantations of which the competitor is Forester. (*Three Medals.*) One to be awarded for the best Report from each of the countries—England, Scotland, and Ireland,—and competition to be confined to each country respectively. Reporters must state the extent of plantations under their charge, the kind of timber grown, soil, situation, management, age, etc. This is a standing subject.

XII. For an approved Report on the Forests of the United States of America. (*A Medal.*)

XIII For an approved Report on the Forests of India. (*A Medal.*)

XIV. For an approved Report on the Forests of any of the British Colonies. (*A Medal.*)

XV. For an approved Report on the Management of Forests on the Continent of Europe. (*A Medal.*)

Special reference to be made to any appliances or modes of culture and treatment not generally adopted in this country, but followed in such Arboricultural schools as those of Nancy and Hanover, and elsewhere. Foreigners are specially invited to compete.

XVI. For an approved Report on the Diseases most incidental to Forest Trees, including those that affect the roots as well as the bark, branches, and foliage. (*A Medal.*)

XVII. For an approved Essay on the Natural History of *Adelgis laricis*, the Larch Bug. (*A Medal.*)

The Essay must include the injury done by the insect to larch, and suggest remedies.

XVIII. For an approved Report on the results obtained by experience of Seedlings of Coniferæ, being the produce of trees grown in Britain, as compared with plants obtained from foreign-ripened seed. (*A Medal.*)

XIX. For an approved Essay on the Best Methods for Seasoning Different Kinds of Timber. (*A Medal.*)

XX. For an approved Essay on the Best Methods of Rearing Timber Trees in Deer Forests for shelter. (*A Medal.*)

XXI. For the best and approved Model of a Rustic Arbour or Summer-house, designed and executed by the Competitor. Model not to exceed three feet in height. (*A Medal.*)

XXII. To any Member of the Society who shall send to the Secretary from abroad, cones or seeds of Forest Trees of new or rare species or varieties, capable of germination, and of thriving in this country. (*A Medal.*)

To be awarded when fifty of any sort, or fifty plants in all, have been successfully raised. These plants to be the property of the Society, and to be balloted for amongst Members intimating their desire to have them. The packages to be delivered free of cost to the Society at any British port.

XXIII. For an approved Essay or Report on any subject connected with Arboriculture. (*A Medal.*)

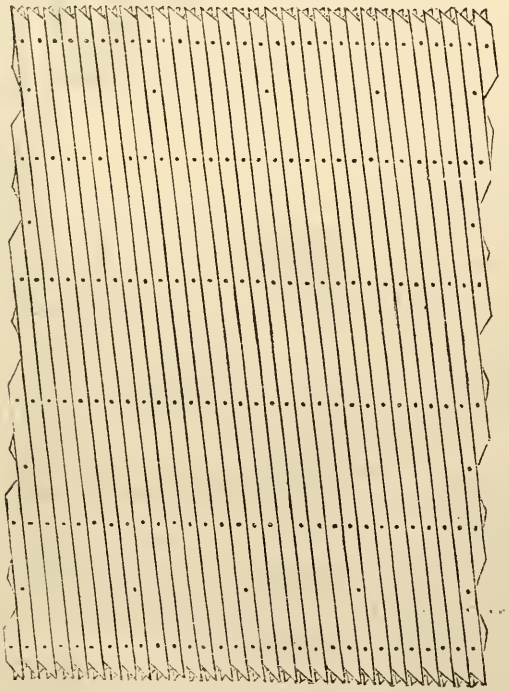
XXIV. For any marked advantageous improvement on any of the

Implements used in Forestry. (Models or Implements to be accompanied by a Report.) (*A Medal.*)

The conditions of competition are as follows:—All Essays and Reports intended for competition must be given in to the Secretary not later than 23rd September, and all Collections of Cones, Seeds, Woods, Geological Specimens, and Rustic Work, not later than 23rd October, 1877—each collection bearing a motto, and being accompanied by a separate sealed envelope bearing the same motto outside, and containing a card with the name and address of the Competitor.

Successful Competitors may either have the medals or their converted values, which are as follows: gold, £5; No. 1 silver (medal and £2 in money), £3; No. 2 silver, £1; bronze, 10s.

Patent Extending Trellis.



This trellis, manufactured by Messrs. S. and C. Causley, of Kingsland Road, London, is a great improvement both in appearance and durability on that in ordinary use. It is generally understood that trellis-work, from its great bulk, does not pay the cost of carriage, but from the extraordinary manner in which this extending trellis closes up, this objection is entirely overcome. Thus, a length 8 ft. by 3 ft. 2 in. will close up, as shown in the engraving, into a solid piece of 2½ feet by 5½ ft. This trellis is remarkably well made; the laths are planed on both sides, and measure 1 in. by ¼ in. thick, and for training climbing plants, garden screens, and other purposes, is certainly superior to anything we have yet seen.

RANSOME'S PATENT TREE-FELLER.

Ransome's Patent Steam Tree-Feller.

The first operation connected with the conversion of timber is felling it Numerous attempts have been made from time to time to fell trees by machinery, with but doubtful success ; the chief cause of failure being that the time occupied in fixing, adjusting, and moving the apparatus from tree to tree has hitherto cost more than felling them by hand. With a view of overcoming this difficulty, Messrs. A. Ransome and Co., of Stanley. Works, Chelsea, have recently patented their Steam Tree-Feller, which is represented by the engraving on the opposite page, and which, as an apparently feasible attempt to lighten the heavy manual labour and expense attending tree-felling, we are pleased to notice.

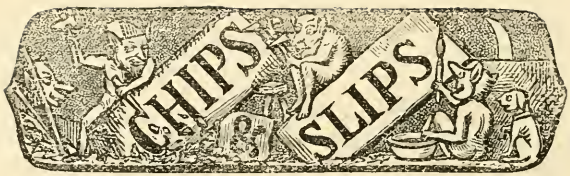
It consists of a steam cylinder of small diameter, having a long stroke, attached to a light cast-iron bed-plate, upon which it is arranged to pivot on its centre, the pivoting motion being readily worked by a lever, as shown in the engraving. The saw is fixed direct to the end of the piston-rod, which is caused to travel in a true line when at work by guides ; and the range of the pivoting motion of the cylinder is such as to enable the saw to pass through the largest logs that are ordinarily to be met with, without moving the bed-plate. A strong wrought-iron strut is attached to the bed-plate, and this is furnished with two fangs, which are made to bite into the butt of the tree by a chain passed round it just below the saw-cut, and drawn taut by a powerful screw.

The machine is supplied with steam at a high pressure from a small portable boiler through a strong flexible steam pipe, and as this may be of considerable length, the boiler may remain in one place until the machine has cut down all the trees within a radius which is determined by the length of the steam pipe.

From the foregoing description it will be clearly seen that the only fixing the machine requires after it is laid down against the tree, is to draw it tight against the butt by the chain and screw above referred to ; and as the whole apparatus, exclusive of the boiler, does not weigh more than about 3 cwt., it is readily carried about slung on poles between four men. The steam pipe does not require to be disconnected while the machine is being removed, and a special valve is attached by which it can be instantly started at any part of the stroke.

As the pressure of steam is high, the machine works with great rapidity, and under ordinary circumstances it will fell from four to six trees, averaging 30 inches in diameter, in an hour ; and as it cuts nearly close to the ground, it saves a considerable amount of timber which is lost when felled with the axe.

As the machine will work in any position, it will fell trees growing on slopes or in hedgerows, and by a simple apparatus, easily attached, it can be fixed so as to crosscut logs to length when lying on the ground.



The *Hamburger Gartenzeitung* reports that last year's harvest of tree, clover, grass, and other seeds was generally very short: consequently, increasing high prices may be expected. Some kinds of grass and clover are no longer to be had first hand. Lucerne especially is very scarce, and clovers are short both in Europe and America. Seed of the Scots pine, Weymouth pine, and *Abies excelsa* was abundant last autumn, whereas larch and silver spruce was almost wholly wanting. Acorns were scarce, and beech mast a total failure. It is a noteworthy fact that the same scarceness or almost total absence of certain fruits extended to this country.

Whale Oil a Cure for Scale on Trees.—Mr. John Downie, the well-known Edinburgh nurseryman, has recently given his experience of this oil as a cure for scale, a too well-known pest on trees. An apple tree was painted in the middle of December, and the cure was most effectual, the tree which had been so infested that it had ceased to bear fruit, and almost to grow at all, making a clean healthy growth, and subsequently coming into a free bearing state. The oil is applied during winter, when the leaves are off the trees; and care must be taken not to injure the buds by rubbing it too hard into them.

It is reported in America that ten million trees have been set out in Minnesota within the past twelvemonth.

Moving Large Trees.—In Paris, at present, instead of planting young plane trees as of old on newly formed boulevards, large and well-furnished trees are planted. Thus the newly formed boulevard Henry IV. is furnished throughout with well-grown plants, with stems nearly 1 ft. in diameter and about 30 ft. high. It will be interesting to notice how they pass through the summer.—*Garden.*

"The Golynos Oak."—This wonderful tree, which overspread 452 square yards of ground, grew on the estate from which it takes its name, about four miles from Newport, in the county of Monmouth. The diameter of the main trunk was nine and a half feet, from which grew, exclusive of dead limbs, twelve branches, the largest of which contained 472 feet of timber, and the whole product of this enormous oak was 2,426 feet. Its bark, which round the trunk measured three inches in thickness, was estimated at six tons. From the rings in the butt it was calculated that the tree had been growing upwards of 400 years, and from many of its lateral branches being dead and some broken off, it is presumed it must have stood after it had attained its maturity little short of a century. It was purchased by the late Mr. Thomas Harrison, many years purveyor of Plymouth Dockyard and Dean Forest, in the year 1810 for 100 guineas, and when converted, its total product was valued at nearly £600. The above was copied from an engraving published by the celebrated publishers, Boydell, Cheapside, T. Clay, Ludgate Hill, and Colnaghi, Cockspur Street.

Tree-Felling by Electricity in India.—A novel and interesting experiment has been attempted in the compound of the Strangers' Home, Mazagon; and there can be little doubt that ultimately great results will accrue from what may at first sight appear to have been not a great success. The experi-

ment referred to was tree-felling by electricity, instead of by the ordinary method of the clumsy axe. The patentees of the process are Mr. H. H. S. Parkinson and Mr. W. H. Martin, both of Bombay; and the experiment was superintended by Dr. Lyons. The plan is simple. The two ends of the copper wires of a galvanic battery are connected with platinum wire, which of course instantly becomes red-hot, and while in that state it is gently see-sawed acrossthe trunk of the tree to be felled. When arrangements were made for the experiment, it was never for a moment doubted that the enterprising merchants of Bombay were possessed of all its made thicknesses of platinum wire, but it turned out that the thickness of the thickest that could be got was only that of crochet cotton. It was at once seen that a wire of such thinness would be consumed before the tree was half severed from its trunk. However, the attempt was made. The burning wire performed its task very well so long as it lasted, but, as anticipated, the wire continually broke, and at length there was no wire left. There can be little doubt that with a stronger battery—the one used was only a twelve-chambered one—and a thicker wire, the experiment would have been entirely successful. As it was, the tree was sawn one-fifth through. It is calculated that under proper conditions a tree, which at present takes two hours to fell, will come to the ground by this process in fifteen minutes. It is almost needless to add that there is no waste of wood no sawdust.—*Homeward Mail.*

Planting Barren Sands.—Every one who knows South Africa is aware that there are extensive and sandy plains on the Cape Flats, between Table Bay and False Bay, as well as in the immediate vicinity of Port Elizabeth, Algoa Bay. On the former, successful plantations have been raised, or other-, wise immense tracts of fertile country would have been swallowed up by the drifting sands, but near Port Elizabeth nothing of the sort has been done. The consequence is that farms have been destroyed, others are threatened, silting up in marine works is increased, and it is difficult to say where or at what point the incursions of the sand will stop. It is imperatively necessary, therefore, to arrest the drift, and use means to this end. People have just been imported from the Landes, in France, who have been accustomed to the successful planting in sand which has long been conducted there. They are to be set to work at once. Thousands of trees are to be planted near Port Elizabeth, and it is quite possible that in a few years a very great and salutary change will be effected.—*South Africa Mail*, Feb. 20.

Mistletoe on a Scotch Fir.—I have seen mistletoe, I think, growing on all the trees enumerated lately by your correspondents except the oak, on which I have never been fortunate enough to find it. The Scotch fir, however, is not among the trees mentioned on which it grows, and it may interest some of your readers to know that I gathered it on this tree many years ago in the Bavarian Tyrol, between Munich and Innspruck. It grew by the road-side in one spot, in an abundant colony; the plants were large and vigorous, and evidently in a thriving condition. I was amazed to find an old friend, which I had always been accustomed to see fed on the sweet juices of apples and poplars, thriving equally well on the austere turpentine of a Conifer. To prevent any chance of mistake, I cut off a branch and brought it home with me. It was a curious example, showing the perfect union of the two plants. —*J. D. Llewelyn, in the "Garden."*

American Trees.—The report of the United States Commissioner for Agriculture for 1875 contains a catalogue of upwards of 400 species of forest trees, including, however, such plants as Yuccas. The same volume contains an elaborate and exhaustive account of the forests of the several States.—*Gardener's Chronicle.*

Exhibition of Bark.—A special international exhibition of leather and oak bark will be held in Berlin in September next. The culture of the oak, says the *Tanners and Curriers' Journal*, is one of the most important and vital questions the leather trade has ever had to resolve. This is a well-known fact to everybody in the trade, and one of the greatest attractions of the exhibition will be to show the state of the oak forests, and encourage their improvement.

Epping Forest.—The final decision was made last week by the Master of the Rolls in the Epping Forest case, awarding an injunction against the continuance

of the fences on the waste lands belonging to the lords of manors. Bush Wood and Lords' Bushes are the principal places which the decree will open, and they are two of the most beautiful spots in the whole forest. Bush Wood particularly contains one of the most beautiful avenues of trees in the neighbourhood of London, and will doubtless be one of the most favoured resorts of the people of the East End during the coming summer.

A PLANT of the *Eucalyptus globulus*, or Australian blue-gum tree, the sanitary properties of which have been so much discussed of late, is now in bloom in the Botanical Gardens at Kew. The tree makes extraordinarily quick growth under favourable conditions, and is considered hardy in dry warm soils and sheltered situations, especially in the southern counties. The genus of gum trees is considered the most important that Australia produces; and some of the species are suitable for all economical purposes for which timber is indispensable, besides furnishing the colonists with several other useful products.

APPOINTMENT.—Mr. James H. Trail, son of the Rev. Dr. Trail, was installed Professor of Botany in Aberdeen University on the 7th April as successor to Emitus Professor Dickie resigned.

A VERY useful pamphlet, entitled *State Forestry, its Aim and Object*, has been published by Captain Campbell Walker, conservator of the New Zealand forests. The pamphlet is based upon a lecture delivered at the Otago Institute, Dunedin, and though, so far as details are concerned, it is intended to apply to New Zealand, yet the general principles laid down apply to all countries. We do not know any publication, certainly none of so small a size, in which the objects to be attained, and the methods to be followed for that purpose, are so clearly and concisely laid down as in the pamphlet before us, which it is to be hoped may be reprinted, so as to obtain a larger circulation among foresters at home, in India and the colonies, than is possible under existing circumstances.—*Gardener's Chronicle.*

TREE PLANTING IN ALGERIA.—The railway companies of Algeria had up to June 1, 1870, planted in the way from Algiers to Oran, 14,400 fruit trees, 98,900 forest trees, and 344,000 trees of different species on the open plains and slopes, making in round numbers 457,000 trees. Since then the number has been sextupled, the company estimating the number actually planted by it on the line as nearly 3,000,000.—*Garden.*

EARL CATHCART, it is stated, proposes erecting a granite memorial on the Court Knowe, to mark the spot where Queen Mary stood and viewed the battle of Langside, just before her flight into England. The memorial will have the old Scottish crown, with the initial "M. R., May ye 13th, 1568." Mr. Legge, granite sculptor, Aberdeen, has been commissioned to execute the work.

CONSIDERABLE public attention has of late years been directed towards the management of the New Forest by Her Majesty's Commissioners of Woods and Forests, and their proposal to disafforest the whole of this the most exteusive and beautiful of all the famous ancient royal forests of England, but which we hope will be most effectually preserved from such ruthless vandalism in all time coming, by the New Forest Bill lately introduced to Parliament by Mr. W. H. Smith, in the name of the Government. We trust that this valuable and much-needed measure may become law before the end of this session, so that not a day may be lost in taking prompt action to conserve what still remains in its natural state of this noble forest and its grand old trees. In doing so, and putting the management and practical superintendence of the forest on a proper footing, so that its amenities may be carefully preserved, and the waste places, heaths, &c., utilized in the best manner for the benefit of the country at large, the Government will deserve and receive the nation's warmest approval.

The bill is founded upon the report of a Select Committee of the House of Commons, which sat during the session of 1875, and was instructed to inquire into and report upon the present condition of affairs in the New Forest and their management, the Commissioners of Woods and Forests' proposal for the complete disafforestation of it, and also into the working of the "Deer Removal Act of 1851," and more particularly into the exercise and effect of the powers of enclosure given by that Act to the Crown.

This ancient forest and hunting-ground of the Norman kings was afforested by William the Conqueror and his immediate successors to the extent of about 93,000 acres, stretching over a district of country about twenty miles long from north to south, and sixteen miles broad from east to west. That part of the forest at present the property of the Crown comprehends an area of about 65,000 acres, lying in the south-west corner of Hampshire, and consists in parts of poor sandy and gravelly soil, rough pasture, moor or bog, heath and woodland, considerable portions of which still retain all the charac-

teristic features and wildness of primitive nature. The whole of this large district lay open and unenclosed until less than two hundred years ago, but an Act was passed in 1698 empowering the Crown to take and enclose 6,000 acres expressly for the growth of oak timber for naval and other purposes. The 6,000 acres were not all enclosed in one place, but scattered in portions all over the forest, no enclosure exceeding 500 acres in extent, and their number being between forty-five and fifty. After being enclosed and planted, each was to remain enclosed only twenty-two years, by which time the young trees were supposed to be out of danger from the browsing of cattle and deer. This limitation of time was taken off in 1808, but the obligation to ultimately throw open the enclosed land was still enforced. By an Act passed in August, 1851, the Commissioners were empowered to remove the deer, and to plant trees other than oaks, and to extend the area enclosed by 10,000 acres, making in all 16,000 acres; taking in land and throwing it open again as of yore. This power has been exercised in the most barbarous and destructive manner imaginable. Instead of enclosing and planting with suitable trees the bare and desolate wastes and heaths, the Commissioners pounced upon the richest and most picturesque parts of the forest, cut down the ancient trees—the living mementoes of bygone centuries—tore up with the plough the rich greensward that had existed for ages, and reduced some of the loveliest bits of landscape scenery in the country to gloomy and monotonous plantations of black fir.

A writer, who knew the district of Old Sloden before 1851, describes it as one of the grandest examples of forest scenery in England:—"Hollies, yews, and whitebeam of the largest growth stood singly or in small groups at intervals, for the full appreciation of their form and colour, and for glimpses of distant landscape. Here and there a shapely oak or beech overhung the evergreen clumps, and aged birches or hawthorns studded the open spaces." This lovely, picturesque spot was one of the first places selected for the operations of official vandalism, displaying an amount of bad taste, and an ignorance of scientific and practical forestry, that will scarcely be credited at the present day. All the fine old trees were swept away; and it is said there were amongst them 300 ancient yews, many of which were probably in existence in Saxon times, and some of them may have been old trees when the Norman Conqueror erected the New Forest. All have been ruthlessly cut down and destroyed, and even the wavy undulations of the land have been submerged in an interminable sea of Scots fir, which would have been in its proper place had it been judiciously planted on the high and bare wastes and moorlands, where it would have produced a profitable crop of timber upon land which is otherwise worthless.

The audacious proposal of the Commissioners to disafforest the whole of the district at length roused a feeling amongst the public which put a stop to these ruinous proceedings, and led to the appointment, in March, 1875, of a Select Committee of the House of Commons, of which Mr. Smith was chairman. This committee took a vast amount of evidence, and made a searching and exhaustive inquiry into the condition of affairs in the New Forest, into the operation of the Act of 1851, and "particularly into the operation and effect of the powers of enclosure given by the Act." In the evidence taken before this committee it was stated that whereas there were 9,000 acres of large old picturesque timber in 1849, that area had been reduced nearly one-half in 1875, and extensive masses of enclosures were pointed out to them, varying from four to ten miles, with scarcely any roads or openings through them.

In a recent leader on the bill the *Daily News* remarks—

The rolling power of enclosure was, in fact, destroying the natural features of the forest, without any adequate result to compensate for the evil; and the commoners maintained that the policy of the Commissioners of Woods and Forests was to enclose only the fruitful pasture land, with the express purpose avowed by the Deputy Surveyor of the Forest before a House of Commons Committee in 1854, of destroying the value of their rights so as to facilitate their acquisition when disafforestation should be resolved on. Happily this Select Committee not only reported against disafforesting the land, but expressly recommended that it should remain open and unenclosed, except to the extent to which it might be expedient to retain the existing right of the Crown to plant trees. This right involves that of enclosing, for a time, certain portions of the land, limited under the existing law to 16,000 acres. At present the whole soil of the forest is subject to be enclosed in this way in its turn, but the committee recommended that in future none should be planted but that over which the power of enclosure has already been exercised. With this limitation, however, they recommend that the Crown should have the power of keeping 16,000 acres under plantation; the rest of the land to be open, and with the especial provision "that the ancient ornamental woods and trees shall be carefully preserved, and the character of the scenery shall be maintained." It is most satisfactory to find that Mr. W. H. Smith's bill faithfully embodies these recommendations. It confines the right of future enclosure to the lands over which the scourge has already passed, which form, however, a very large portion of the forest, and it limits the amount to be enclosed at any one time to 16,000 acres. It authorizes the sale or exchange of portions which are intermixed with the lands of other proprietors on condition that the proceeds of the sale are invested in buying other land to be added to the forest; and it reconstitutes the ancient Court of Verderers, and gives them new power to regulate the exercise of the commoners' rights and to prevent encroachment. Practically, therefore, it rescues the New Forest from the spoiler, and puts it under the guardianship of a body which represents those who are most directly concerned in keeping it open for public use.

The forest, thus dedicated to the public, is to be governed by a Court of Swainmote, which, as we gather from the bill, is not to consist, as in old English forestry, of all the swains or freeholders in the forest, but of the

verderers only. These verderers are to be seven in number, six elected and one officially appointed. An elective verderer must have a property qualification consisting of not less than a hundred and fifty acres of land to which some right of common over the forest is attached. The franchise for the election of these verderers is pretty widely spread. All the parliamentary voters in any parish or township, any portion of which is situate within the perambulation of the forest, are to have votes for the verderers, and all who are on the register of persons having rights of common over the forest. These rights of common belong to some 65,000 acres of land, about two-thirds of which are outside the forest. There are, besides, rights of turbary, or in other words of cutting turf, heath, and ling for fuel, which attach to about 1,500 cottages. A turbary right extends, we understand, to the cutting of about 4,000 turves annually; the turf, it is said, renews itself, and is cut only on land which is so poor as to be of little use for any other purpose. The verderers are to have very large powers under the bill for preventing encroachments and punishing breaches of the law. Each verderer is to be a justice of the peace in and for the forest, and a Court of Swainmote, when transacting judicial business, is to be deemed a court of petty sessions, as if the forest were a petty sessional division. Some other details of the bill are perhaps open to improvement, but its main features seem to us to be all that could be desired. The election, for example, should be by ballot and not by open voting; and the verderers ought to have the power of objecting to re-enclosures, which the sixth clause specially withholds from them. The ornamental woods and trees, moreover, should, as the Select Committee advised, be "carefully preserved," and not, as the eighth clause enacts, be preserved "so far as is practicable," since the Commissioners of Woods and Forests have already shown conclusively that their discretion in such matters cannot be too highly relied on.

On the whole, the bill is a most satisfactory one, and Mr. W. H. Smith deserves the best thanks of all who are interested in the preservation of our ancient forests and their grand old trees and picturesque landscapes, with what remains of their pristine grandeur and the unalienable right of the public to the free enjoyment of them, under judicious and beneficial laws and regulations, to prevent wanton mischief, or abuse by the individual of the national rights.

With such an extent of forest land in the hands of the Government, so much in want of thorough scientific and practical treatment, in the proper preservation of its amenities, and the judicious improvement and planting of its wastes and moorlands, there need be no difficulty worth naming in the way of Government establishing a School of Forestry in the South of England, where scientific and practical forestry could be as well and efficiently taught and practised as in the forest schools of France or Germany. With a properly equipped and well-managed school in the New Forest there would be no necessity to send the candidates for appointments in our Indian and colonial forests to the

Continental schools to acquire knowledge which can be far better and more cheaply imparted at home, if our Government would only have the courage to do its duty to the country, in taking the initiative in carrying out a matter of such great importance to the welfare and industry of our world-wide empire.

We have received several letters from our correspondents upon the subject of the institution of forest schools by the Government, and without exception they agree with what we advocated in our first number, that it is undeniably the duty of the Government to see that such an important branch of national education shall be provided for the proper instruction of those youths who will ultimately have the control and management of the forests of the British empire, and upon whose ability and knowledge so much of our national prosperity must of necessity depend.

Other civilized nations have got a long start of us, and it can hardly be imagined that the British Government have so lagged behind in this matter, until many parts of our Indian and colonial possessions are converted into deserts from the neglect and mismanagement of their natural forests. To fully cope with such ruinous waste it is imperatively necessary that immediate steps be taken to specially train and educate young men for the profession of forestry, so that we may have the means within ourselves for providing thoroughly educated foresters fully qualified in every respect to undertake the superintendence of our forests at home and abroad. It is quite within the range of probability that the best of the Continental forest schools may at any time be closed by the outbreak of war, or for other sufficient reasons, against arboricultural students from this country, when we should be thrown upon our own resources for a scientific arboricultural education; and knowing this fact, it is perfectly suicidal for this country to permit of farther neglect inestablishing at least *one* properly equipped forest school. Besides, the results of sending candidates for Indian forest appointments have not been so satisfactory as to warrant it being said that we cannot educate them much better at home, and turn out superior foresters, with education and energy to master every detail in the thorough and economical management of the most extensive forests in the world, and with perseverance and determination to carry their knowledge and ability to a successful issue. Our able correspondent, Dr. J. C. Brown, lately laid before the Town Council of Edinburgh his proposal to found a School of Forestry in connection with the new Arboretum, the Botanic Garden, and the educational institutions of that famous seat of learning. After due consideration the Town

Council wisely declined action in the matter, as it is not within their province to interfere with and expend the city's funds in the promotion of an object which it is the clear duty of the Government to promote and establish for the national benefit. There can be no better place found in Britain than Edinburgh for the creation of a Forest School, and we hope to see such an institution established there at no distant date; but the matter must be kept before the public, and pressed upon the attention of the Government until the school is a matured fact, and the school erected upon a thoroughly sound and satisfactory basis. In furtherance of that object we would invite the opinions of those who are interested in the subject, so that the matter may be properly ventilated, and some satisfactory conclusion arrived at.

THE Highland and Agricultural Society of Scotland holds periodical meetings at which candidates may be examined for certificates in forestry. The Board of Examiners is composed of the most eminent men in the several branches of scientific and practical forestry, and the syllabus of examination is a most excellent one, carefully drawn up and graduated so as to meet the requirements of forestry, and suit the abilities of possible candidates. Still, with all the advantages held out to foresters possessing those certificates, the number of those who come forward for examination is lamentably small, considering the large number of foresters in Britain, and those who are directly interested in the skilful and profitable management of our woods and forests. These examinations have existed since 1870, with the poor result of *five* candidates having passed for first-class certificates in *seven years!* none having passed since 1873, and it appears that only *two* out of those five have been practical foresters.

We do not hesitate to say that the principal reason for such a deplorable state of matters is the want of proper means for acquiring the necessary preliminary education, such as a properly equipped forest school would impart, so as to enable candidates to come up for examination with confidence that they were fully prepared to undergo the severest tests as to their technical, practical, and scientific knowledge of forestry. At present each forester is left to his own personal resources for acquiring a scientific knowledge of the profession from such books and periodicals as he may have the ability and wisdom to select, and the perseverance to study, but with no one of authority to guide and advise him as to what portion of his readings he ought to adopt and study closely, and what to discard as unworthy of study; so that it is almost a miracle that even two

practical foresters have been found who have passed with high credit the excellent standard of efficiency stipulated for by the Highland and Agricultural Society. Such a state of affairs can only be remedied by the institution of thoroughly equipped forest schools; and this eminent and influential society, which has done so much in the past for the prosperity of rural industry, would confer a great benefit on the nation at large, and forestry in particular, if it would turn its diligent attention and influence to the early promotion and establishment of a British school of forestry, under the direct authority and management of the Government.

THE elder, bourtree, or boon-tree (*Sambucus nigra*), is one of the hardiest of our indigenous plants, growing freely and even luxuriantly in high and exposed situations where few other shrubs can exist, braving the stormiest winds and severest winters in such places with the greatest impunity. We have often seen it used with excellent effect for fences and shelter around high-lying farms and cottages, whose inhabitants appear to appreciate it as their best friend for mellowing the blast and sheltering their stock and garden crops from the cold and boisterous winds to which they are exposed in elevated parts of the country. When once it has established itself, which it quickly does in almost any soil and situation, it is not easy to eradicate it, which makes it rather troublesome when growing amidst young plantations; but there is no better tree or shrub for planting thickly along the skirts of new plantations in high and exposed parts, where it speedily gives the necessary shelter to the young trees to leeward of it, protecting them from being tossed about and injured by the cutting blast, and enabling them to quickly start into strong and healthy growth, which is a most important point gained towards the future value of the plantation, and one to which those who have to plant in high and exposed places should devote their most careful attention. When it has once been decided to plant such exposed places no time should be lost in erecting the necessary fences, but as these are not generally of a nature to afford much shelter, such quick-growing and hardy plants as the elder ought to be thickly planted immediately inside the fence, extending three or four yards inwards, especially on the sides most exposed to the wind. When possible this should be done the season before the timber trees are planted, so that the shelter may have the start, and afford immediate protection to the young trees.

THE *Berberis Darwinii*, a beautiful evergreen shrub introduced in the year 1847 from the island of Chiloe and the western shores of Patagonia, has proved to be one of the hardiest and most ornamental of the shrubs grown in the gardens and pleasure-grounds of this country. The foliage is neat and pleasing at all times, and the plant is covered in spring with a gorgeous shower of dark golden blossoms, succeeded in the autumn by an abundant crop of bluish-purple berries, which form a rich contrast to the dark green foliage until they are devoured by game and other birds, many of which feed greedily upon them when other food is becoming scarce, late in the autumn. The berries produce seeds freely, which ripen perfectly in this country, and from which large quantities of plants can be raised at a cheap rate to meet any demands, so that it ought now to be extensively used in the formation of game covers, for which it is very well adapted, affording as it does a dry, warm, and almost impenetrable lair for game; and in the autumn and early winter the berries provide a large supply of wholesome food for pheasants and other birds.

It grows freely in almost any soil if moderately dry, but it thrives best in a light calcareous soil, with an open dry subsoil, and being a native of a moist climate, it grows more luxuriantly in the western parts of Britain and in Ireland than in the eastern and drier districts.

The School of Forestry in the Royal Wurtemburg Academy of Land and Forest Economy.

By the REV. J. CROUMBIE BROWN, LL.D.

The Royal Wurtemburg Academy of Land and Forest Economy at Hohenheim is a palatial edifice supplied with all requisites for the study of rural economy, agriculture, and forestry. It is surrounded with grounds of considerable extent, including experimental and botanic gardens; and is supplied with other facilities for the study of practical operations. Instruction is communicated by lectures, exercises, excursions, and experimental work.

The curriculum extends over two years, divided into four sessions, one commencing on October 15th and closing on 9th March, the other commencing on 1st of April and closing on 15th of August, and this is followed by a vacation of two months.

There are three distinct departments of study—*Land—wirthschaftliche Disciplinen,* embracing what relates to agriculture and rural economy; *Forst—wirthschaftliche Disciplinen,* embracing what relates to the treatment of forests; and *Grund und Hilfs—wissenschaften,* or fundamental and accessory sciences; and the arrangements are such that students can avail themselves of the provision for instruction in either the one or the other of the two first-mentioned branches of study, or to the full extent of the provision for instruction in one and to some extent partially of the provision for instruction in the other,—and in any of these cases with or without availing themselves of the provision made for instruction in the fundamental and accessory sciences.

The subjects of study are the following, but the order in which they are studied is not that now given, that being definitely determined by provision for the convenience of the professors and students.

I. Rural Economy.

A. History and literature of rural economy

B. Agriculture and rural productions. General doctrine in regard to agricultural productions, and to the reclaiming and drainage of land.

a. Agricultural implements and machines.

b. Special doctrine in regard to cereals and similar products. In addition to which in the concluding session special lectures are given, on the growth and production of hops and of tobacco; on lime-making ; on the culture of fruit-trees; and on the culture of culinary vegetables.

c. General doctrine in regard to the rearing of animals, with application of the same to the breeding of sheep and preparation of wool; and in the last session special instruction is given in regard to the breeding of horses, of oxen, and of small cattle, on silk-culture, and on the keeping of bees.

C. Rural economy.

a. Treatment and disposal of economical products.

b. Valuations, estimates, and exercises in drawing out schemes of operations.

c. Bookkeeping.

D. Technology of rural economy.

In connection with these series of lectures are given appropriate illustrations in the collections of models, of implements and of machines, in the Museums of Wood and of Soils, in the experimental fields, in the nurseries and the arboretum, and different gardens, in the cattle-folds and in the workshops of the institution, together with practical exercises in making valuations, estimates, and schemes of exploitation, excursions, &c., &c.

II. Forest Economy.

A. Encyclopædic view of forest economy, with a special reference to the study by students of rural economy of allied subjects in this department.

B. History and literature of forest economy.

C. Forest products.

a. Forest botany.

b. Sylviculture.

c. Forest protection.

d. Technical properties of timber.

e. Uses of forests, and forest technology.

D. Forest economy.

a. Mensuration of trees and forests.

b. Partition of forests for exploitation.

c. Valuation of forests.

d. Practical management of forests.

E. Administration of Crown forests. A special introductory lecture on the subject and exposition of the forest laws of the kingdom of Wurtemburg.

F. Encyclopædic view of rural economy for the instruction of

foresters. In connection with these series of lectures there are given, in occasional extensive, and in regular less extensive excursions, &c., similar to those connected with instruction in rural economy, appropriate demonstrations in different forest districts, in the Botanical Garden and Museum of Forest Products, and practical exercises in the calculation of cubic measurement of trees and cubic contents of woods, in the laying out of forests for exploitation.

III. Fundamental and Accessory Sciences.

A. Political economy.

B. Agriculture.

C. Jurisprudence. Legislation in regard to Wurtemburg forest management; legislation in regard to rural economy.

D. Mathematics—arithmetic, algebra, plane geometry, geometry of solids, trigonometry, practical application of geometry. In connection with this there is regular practice in land surveying and levelling, and in the mensuration of forests with the odolite.

E. Physical Science—experimental natural philosophy; meteorology; experimental chemistry; agricultural chemistry; production of fodder; physical geography; geology; technical mineralogy; botany; anatomy and physiology of plants; diseases of plants; special botany; anatomy and physiology of domestic animals; zoology; special zoology; introduction to the use of the microscope. In connection with these studies there is practice in the chemical laboratory, demonstrations in the Botanical Museum and Garden, and in the experimental fields of the Rural Economy Experimental Farm, and regular botanical and geological excursions, &c.

F. Veterinary science.

a. Materia medica and formulas of recipes.

b. Pathology and therapeutics of domestic animals.

c. Special lectures on epidemics. Veterinary assistance in the birth of animals.

d. Theory of shoeing.

G. Technical arts—rural architecture; preparation of plans.

Besides which, from time to time lectures are given on general science, and on subjects connected therewith.

The regular course of study of forest economy extends over two years, but every year the lectures are attended by amateur students or others, who are not required to go through the whole course; and the Director is always ready, as are also the collective body of instructors, to aid such in determining how long they should remain, and what classes they should attend, with a view to making the most of the time they can spend there.

Of all students applying for admission there are required—

1. Certificate that they are above eighteen years of age; but in rare

exceptional cases, by special resolution of the *Senatus Academicus,* youths who have not yet completed the eighteenth year of their age may be admitted.

2. Certificate in regard to previous course of study. In case of the applicant having previously studied at the university, or other superior educational institution, there must be produced a regular certificate of disjunction from the officials of the college.

3. In case the applicant, according to the law of his domicile be not of age, a certificate from his parents or guardians of their consent to his joining the Academy, or otherwise evidence of his being independent and free to act for himself.

4. Subscription to obligation to conform to the statutes issued for behaviour of students in the Academy, a printed copy of which is supplied to every student. Foreigners are further required to produce a passport, or a ticket of legitimation from the proper authorities.

From students of forestry designed for the forest service of the State, in accordance with royal ordinance of 20th January, 1868, *In Betreff der Forstdiens prüfung,* and order of the *R. Ministorium des Kirchen, und Schul wesens* of the 19th June, 1873, in regard to the *Maturitäts prüfung,* there is required, in addition to what has been stated, the certificate of having passed an examination of qualification for entrance on advanced studies.

And from students of forestry who have no view to entering the forest service of the State there is required, as is required of the students of rural economy, satisfactory testimony of their possessing the scholarship and training necessary for profitably availing themselves of the instructions given in the Academy. When they do not already possess a certificate or graduation diploma indicative of their attainments, this may be obtained in connection with their attendance at the Academy, which is valid as a qualification for the same.

Others than students, gentlemen whose views are to make themselves acquainted with the discipline and teaching in the Academy or other institutions at Hohenheim, may remain as *Hospitanten.* The admission of such as a rule does not take place at the commencement of a session, but some six weeks or more thereafter, and the stay of such as *Hospitanten* is limited to four weeks.

In cases of students having to leave the Academy, at least fourteen days' notice must be given of their intention, excepting in admitted cases of necessity.

On regular departure from the Academy a certificate in a prescribed form is given to any student, stating the time he has spent in the Academy, the lectures he has attended, the character of his behaviour, and if he deserve it, the diligence with which he has prosecuted his studies.

Diplomas are granted at the close of their course to students of rural economy, but some attend only a short period. To these and to students of forest economy an opportunity is given at the close of each session, by written exercises and *viva voce* examinations, to obtain certificates in regard to their attainments in such of the branches of study as they may desire.

Prizes also are offered as encouragements to study, and the fact of one or more prizes having been taken relieves the student of the necessity to prepare written exercises while under examination for his diploma.

A certificate in regard to his attainments can be obtained by the student only in the form of one or more of these certificates given after examination at the close of each session, and only in the case of his having submitted to one or more of these examinations. On special application a student may, while pursuing his studies in the Academy, obtain an interim certificate in regard to his diligence and behaviour.

In case of any student being expelled, the fees, &c., paid are not returned. This is also the case if permission to leave in the course of a session be applied for and granted. But in case of sickness, or of a summons to military service, on special application, the fees, &c., in question will be repaid.

For lodging, instruction, and the management of the institution, students of rural economy, if subjects of Wurtemburg, pay 180 marks (£9) per annum; if foreigners, they pay 500 marks (£25) the first year, and 350 marks (£17 10s.) the second. Students of forest economy, if subjects of Wurtemburg, pay also 180 marks (£9) per annum; if foreigners, 350 marks (£17 10s.) each year; and by paying extra fees these latter may also attend classes connected more immediately with rural economy, which do not come within the range of their prescribed studies.

Hospitanten, who are subjects of Wurtemburg, pay for the use of an apartment one mark a day; but they have to provide their own bed and bedding, and they are free to attend all lectures, and avail themselves of all the means of instruction offered by the Academy. *Hospitanten* who are foreigners have the same liberty, and they are provided with bed and bedding, for which and the use of the apartment they are charged two marks a day. Each of the students has a furnished room, and those who are foreigners are supplied with bed, bedding, and towels; these three requisites students, subjects of Wurtemburg, provide for themselves. Arrangements may be made for the occupation of better rooms, or for living outside the Academy: these I need not detail. In regard to food each student may make his own arrangements. He may dine outside, or at the college table. The average expense of board is about two marks a day. Those who

board in the Academy lodge with the house steward, and pay 140 marks at the beginning of each session, from which is deducted monthly the amount of their monthly bill.

It is made a special condition of the appointment of the house steward that he, on due remuneration, must provide food for sick students, whether they take their food daily from him or not, and to prepare either such food as they themselves may desire, or such as may be prescribed by their medical attendant, preparing it well and serving it either in their own room, or in the hospital of the Academy as occasion may require.

Amongst the numerous provisions for facilitating study at the Academy of Hohenheim, many of which relate more especially to agriculture and rural economy, there is a forest district of about 2,200 hectares or 5,500 acres, partly composed of Crown forests and partly of communal forests, embracing different kinds of soil, different forms of management, and different modes of culture, which are under the direction of one of the two professors of forest economy; and besides this *Forstrevier* there are others, in the vicinity of Hohenheim, to which access is had, and also an arboricultural experimental garden.

There is a botanic garden of 4½ hectares or 12¼ acres with some 2,000 species and varieties of plants of importance in forest and in naval economy; and a so-called exotic garden of about 8 hectares or 20 acres, laid out with a special view to instruction in forest botany.

There is a collection of models of implements, machines, and structures pertaining to forest economy; a museum of forest products, and one of forest manufactures, &c. Some of the models are of full size and in working order, others are in section or constructed on a reduced scale.

A mineralogical cabinet, with a collection of geological formations and fossils employed in illustration of lectures, contains about 14,000 specimens.

A botanical museum contains different herbaria, numbering conjointly 10,000 species, with several specimens of many, and a collection of numerous microscopic preparations, a collection of vegetable pathological specimens illustrative of diseased malformation, also many models of flowers, fruits, furze, &c., and finally a collection of some 7,000 specimens of fruits and seeds. There is a chemical laboratory, with 16 double stations for students, provided with all the necessary appliances for work. A cabinet of natural philosophy containing instruments and apparatus required for instruction of the students in mathematics, mensuration, and natural philosophy. A library containing about 10,000 volumes, open to the

use of the students. An experimental forest station, with experimental garden, and a station for making and recording meteorological observations. For the use of the chemical laboratory and chemical agents a charge of eight marks, or eight shillings, per session is made to the students of practical chemistry.

There is also a reading-room provided with newspapers and periodicals, for the purchase of which a charge of four marks each session is made.

Forest Songs and Poetry.

THE WOODMAN'S CRAFT.

O, THE woodman's craft is a goodly craft,
He sings through sun and showers;
As strong and brown as his hatchet's haft,
As simple as the flowers;
Of pleasure or toil he nothing lacks,
As he carols his song and he swings his axe
In spring-decked forest bowers.

When all the winds of March are blown,
And apple boughs are budding;
When swallows from the south have flown,
And little cloudlets, scudding
Across the sun, scarce dim his rays,
Full merry and fair are the woodland ways
When April streams are flooding.

Beneath the ash, whose barren head
Still looms all dark and frowning—
Beneath the gracious green and red
That makes the young oak's crowning—
Last autumn's leaves can scarcely hide
The tufts of primrose, morning-eyed,
With cloak of winter's browning.

Then merrily ring the axes keen
Where stalwart arms are swinging;
And goodly shows the broad blade's sheen,
The sunbeams backward flinging,
As thicket's marge and hidden glades
Ring clearer than the ringing blades
With woodmen's jovial singing.

A goodly craft, and a gentle craft,
And a craft no evil fearing,
Is theirs who live by helve and haft
Where thickets are for clearing,
As the good man's hatchet swings aloft,
And the good wife sings from the binding-croft,
When summer days are nearing.

B. Montgomerie Rankin, in "London Society."

Some Observations on the Mode of Measuring Timber.

By J. W. BARRY, OF FYLINGDALES, WHITBY.

The following remarks are intended chiefly to be by way of suggestion. On taking up the subject of the measurement and valuation of timber, I was greatly struck with the extreme roughness of the method of mensuration now in use. I was astonished to find that the measurement of a large amount of timber on the principle still in vogue presents a considerable deviation from the ordinary mathematical calculations; and I was tempted to wonder how it has happened, in these days of reform and demanding an account of everything, that landed proprietors and sellers of timber should be content with a method which, on paper at any rate, deprives them of a certain percentage of their property.

The facts cannot be new to the readers of this Journal; and I merely invite an answer to my question, "How is it, with these facts before them, that the present system of mensuration has prevailed with dealers in timber?" The existence of a thing is, as a rule, a presumption in its favour; and I should therefore like to know whether or no the simplicity of estimating the contents of a tree by the quarter-girth principle is an ample compensation for its inaccuracy?

To begin at the beginning, the contents of a solid figure are, as we all very well know, ascertained by multiplying together (to use a useful though I believe an incorrect expression) the length, and the breadth, and the depth. Or we may take any two of these together, as forming the area of a side or an end, and may say, for example, of a block of wood that the contents are found by multiplying the area of one end by the length. If the block of wood has a square or a rectangular end, the calculation of its area is easy enough; but if, as is always the case in nature, the end is circular, or of some form approaching the circle, it then becomes a very different and a very difficult matter to calculate the area in question. The *exact* estimate, indeed, of the area of a circle is, as we all know, one of the unsolved and doubtless insoluble problems of mathematics. The attempt to find an answer has driven learned men into idiocy, and until some inhabitant comes down to enlighten us from some of those spheres where absolute knowledge exists, it is likely to be a question

which will ever continue to baffle our inquiries. This, however, need not prevent us from making approximations to what must be the truth; and common sense tells us that the nearer we can make the approximation, without causing practical inconvenience from long arrays of figures, the better of course it will be.

Various such approximations have been made by mathematicians, Van Culen estimated that the area of a circle was equal to ·7854 of the square of its diameter. Metius, with smaller figures, reckoned it at $\frac{355}{452}$ of the same degree. But the proportion which of all others seems (to myself at any rate) to steer the middle way between truth and convenience is that given by no less ancient a personage than Archimedes, who estimated that $\frac{11}{14}$ of the square of the diameter would give the area of any circle.

All these are instances of deducing the area of a circle from our knowledge of its diameter. We may also deduce it from our knowledge of its circumference. ·07958 of the square of the circumference will, the mathematicians tell us, give its area.

Or we may, after the fashion in use, endeavour to discover the area of the circular end by squaring the circle in another manner, by finding the side of a square which shall nearly be equal to the circle; and so we shall be able to deal with the rounded tree as if it were a squared piece of timber. But here be pleased to note the proportions of such a side to the circumference, as used for practical purposes, and as stated by the mathematicians. We assume for practical purposes that one quarter of the circumference is equal to the side of such a square; that is to say, 25 per cent. of the inches which make its extent, or ·2500. But the proportion given by the mathematicians is considerably different. The proportion which such a side bears to the circumference is, they say, larger than ·2500; for it is ·2821, or 28·21 per cent. of the inches of the circumference, or longer by 12·84 per cent. of inches than we usually make it. We see, therefore, at the very beginning that we start with a considerable error; and consequently, when we square the side to give the area of the end or place where it is taken, we multiply the error also; we magnify it again when we have to multiply the result by the length to give the contents; and when we have to add together some hundreds or thousands of trees measured in this manner, the error becomes very considerable indeed.

Suppose, by way of example, that we take the girth of a piece of oak timber as 100 inches; then the side of a square nearly equal to the circle will, according to the method now in use, be one quarter of this extent, or 25 inches; and consequently the area given by a square with a side of these dimensions will be 625 square inches. But according to the more exact method of which we have been

speaking, such a side will be 28·21 inches, and the area consequent on it 795·8041 square inches, a difference already obtained of 170·8041 square inches. Let us next suppose that the piece of timber is 40 feet in length, then the contents will, if we take the side first given, be $173\frac{11}{18}$ cubic feet; but if we take the other, they will be 221·056694 cubic feet; or we may say approximately, $221\frac{1}{18}$ cubic feet. They are found to be more by $47\frac{4}{9}$ cubic feet (or fully 26 per cent.) than they were as given by the ordinary measurement. Suppose further that this oak timber be valued at 2s. the foot, a loss of £4 15s. $10\frac{2}{9}$d. will then be sustained by the seller on that tree alone. Suppose again that an acre of such oak timber be taken down, containing 50 trees which average these dimensions (I make the figures high that we may read the principle in large letters), there will then be a total loss to the seller of £239 14s. $5\frac{1}{9}$d. per acre of such.

A similar result is obtained by estimating the area of a circular end in any of the other ways above alluded to. There is but little difference between them; but they all agree in differing greatly from all the results given by the quarter-girth method. By any of them we find that a piece of timber so measured may be made to contain about 26 per cent. more timber than we now estimate it at; that is to say, we must add somewhat more than one-fourth of what we have already measured, and somewhat less than one-third—we might put it at $\frac{5}{18}$ or $\frac{2}{7}$ to make the result an approximation to the truth.

Nor is this all. A tree will measure, we know, less or more accordingly as it is measured in one or in several pieces. Mr. Hoppus shows in the introduction to his "Tables," that nearly one-sixth as much' again may be gained if we measure a tree in three pieces instead of in one. If, therefore, a purchaser has bought a tree measured in one piece he can sell it himself at exactly the same price per foot, and yet realize one-sixth, or more than sixteen per cent. as much again, simply by cutting the tree into three parts. The same purchaser will also, if our remarks are true, have discovered on squaring the tree that he will have gained twenty-six per cent. of timber (though it may not be useful timber) by the inexact method used by the seller of squaring the circle. Putting the two together, therefore, he will have gained on the whole forty-two per cent., or nearly half as much again as had been measured to him of timber—a useful and an important consideration.

I must be understood here to have been speaking of cases where trees are either measured with the bark off, or when a deduction has been made from their contents for bark. For if we measure the trees with the bark on, and make no deduction for the latter, then the quarter-girth measure does indeed form a tolerable approximation to the results given by mathematicians; and we may for practical pur-

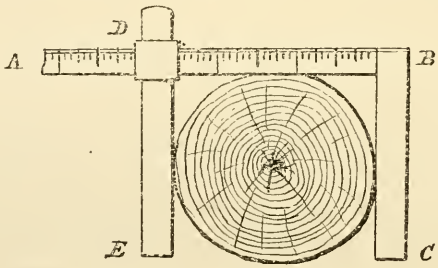
poses assume that the loss of timber caused by the reckoning in of the bark is equal to the loss of timber consequent on the inexact system of measurement. Yet in no cases, we must remember, is the deduction for bark quite so great; and in many cases it is very far from being as great as the deduction to be made for inexact measurement. Mr. Hoppus mentions $\frac{1}{10}$ or $\frac{1}{11}$ of the circumference as a fair deduction for oak bark. A deduction of $\frac{1}{10}$ from a circumference of 100 inches will give a quarter-girth of $22\frac{1}{2}$ inches, instead of one of 25 inches. The former girth, according to the "Tables," gives (with a length of 40 feet) 140 cubic feet 7 inches and fractions; the latter, 173 cubic feet 7 inches and fractions; or a deduction of about 33 cubic feet from the total contents measured with the bark. Reducing this to a per-centage, we make a deduction of about 19 per cent. for bark. Now the deduction made for inaccurate measurement was, we saw, $47\frac{4}{9}$ cubic feet, out of the contents, $221\frac{1}{18}$ cubic feet; and this reduced to a per-centage is about $20\frac{1}{2}$ per cent. We see, therefore, that the two deductions form a tolerably close approximation to one another. We must remember, however, as we said, that $\frac{1}{10}$ of the circumference is about the largest deduction which should be made, and that in the cases of other trees it should form a less proportion.

We must remember, moreover, if we measure with the bark on, and then make a deduction, that the question stands precisely as it was before, and that we are treating the tree as if the bark were off. It is to the latter cases that these remarks apply, and I repeat that if in these cases we measure trees by the ordinary quarter-girth method, we are losing $21\frac{1}{2}$ per cent. of our property, whereas by measuring them in a more exact manner we may add in all cases 26 per cent. to the results already found, and if we take care to measure in more pieces than one, we may add almost half as much again to the same.

If, therefore, exactitude is an object to be attained, any of the following courses is open to us:—Either, *first*, we must not deduct the bark from the total contents in measuring trees with the bark on; or *secondly*, if we do so, we must add 26 per cent. as much again, or between one-fourth and one-third to the contents already found; or *thirdly*, we must adopt a new system of mensuration. The most obvious reform which presents itself, and one which obviates the necessity of calculating new tables, would be to alter the spaces of the quarter-girthing tape. We have to obtain a side which shall be larger by 12·84 per cent. of inches than one quarter exactly of the girth. We might make the 4-inch spaces therefore somewhat less, and yet number them 1 inch, 2 inch, 3 inch, &c., as now. If this were calculated out, a correct result would at once be attained. Or we might start from another datum than that of the quarter-girth. We might take the whole girth, and calculate out the result by the

mathematical ratio given; or we might start with the diameter and use the Archimedean formula, $\frac{11}{14}$ of the square of the diameter will equal the area of the circle. For my own part, I rather lean to this last method, first—because the sum is fairly simple and yet tolerably exact; and secondly, because the diameter is more obvious to the eye, and a knowledge of it gives the inexperienced a more vivid idea of the size of the tree than a knowledge of the circumference only. For my own part, I confess I always find it necessary when hearing or reading of such and such a large tree being of such and such a circumference, to reduce this to its diameter, in order to give myself an exact picture of its size.

The diameter, I might add, is easily obtained by an instrument, as



shown in the accompanying engraving—A B C is a T square; A B being marked out into feet and inches. D E is a sliding joint, moving perpendicularly to A B.

I am having an instrument made on this principle for my own use when travelling abroad. A common walking-stick is split down the middle, and opens out to a T square, marked in feet and inches. It is without the sliding rule D E, but the eye will be sufficient for ordinary purposes of observation. When alone, even if provided with a tape, it is more convenient practically to take the diameter than the circumference of a large tree; and the instrument which takes it has the advantage of being useful and not incommodious as well.

I need hardly add, by way of conclusion, that we can infer the dimensions of the quarter girth from our knowledge of the diameter as well as from our knowledge of the circumference. Taking the latter roughly to represent $3\frac{1}{7}$ diameters, the ratio of the quarter-girth to the diameter is as 11 to 14; and the difference between a result obtained by the quarter-girth on this datum, and that obtained by the method of Archimedes is precisely this: that according to the ordinary method the area of the circle is equal to the square of $\frac{11}{44}$ of the diameter, but according to the method of Archimedes it is equal to $\frac{11}{44}$ of the diameter squared.

Woodlands in Sussex.

By H. T. UPTON, FORESTER, PETWORTH PARK, SUSSEX.

The cultivation of underwood as a source of annual income and profit has probably been carried out to a greater extent in Sussex and the surrounding counties of Kent, Surrey, and Hampshire than in any other part of England; therefore some account of the system pursued may be of interest.

Plantations here are formed almost invariably for the growth of underwood, and but seldom for that of timber, oak being indigenous to the soil, freely reproducing itself from self-sown acorns; care in preserving the tillers as they come up, and their proper thinning as they increase in growth, being nearly all that is necessary to ensure a crop of timber.

The woodlands may be divided into three classes: 1st, land wholly under timber; 2nd, lands partly under timber and partly underwood and 3rdly, plantations wholly underwood, the second class forming the principal portion. The underwood on these lands being formerly composed almost entirely of hazel, has of late years been much improved by filling up the bare and vacant spaces with ash, birch, or Spanish chestnut. Plantations that are of comparatively recent date are formed, in some cases, altogether of Spanish chestnut, where the soil is found suitable to its growth, or of a mixture of ash, birch, and chestnut; willow and alder are also planted in damp or boggy situations.

The underwood is sold chiefly by public auction, the sales taking place from the middle of October to the end of November in each year in lots of about two to six acres, although frequently larger and smaller lots may be put up, depending on the size of the plantation or the quality of the wood; the price being generally at so much per statute acre, but sometimes by the piece. The age at which the underwood is cut varies from eight to twelve years' growth, plantations being cut at an earlier age than underwood grown beneath timber. Good planted stuff will fetch from £2 to £4 per acre per year's growth; £30 to £35 per acre being generally the highest price made, average planted stuff of eight or nine years' growth selling at from £16 to £25 per acre.

The price of underwood reached its climax in the winter of 1873, after which it fell considerably in value till lately, owing chiefly to the increased cost of labour for cutting and conversion; but the above-mentioned prices were again obtained during the past season.

The underwood is principally converted into hoops for barrels, tubs, &c., the wood being split, shaved, and tied up into bundles in lengths of 14 feet, the longest size, down to 2½ feet; 60 pieces making a bundle of 14 feet, and 360 pieces a bundle of 2½ feet; 30 bundles making a load of hoops in all lengths. Hazel is generally converted into hurdles for folding sheep, whilst ash is frequently picked out for hop-poles; the trimmings, and very rough, crooked stuff being made into bavins or fagots for fuel.

The conditions under which the underwood is sold are pretty generally as follows, although they vary somewhat in different localities:—

"Except that the auctioneers reserve the right of refusing a bidding, the highest bidder to be the buyer, and if any dispute arise between two or more bidders the lot shall be immediately put up again.

"No person to advance less than five shillings at each bid, and shall not retract his bidding.

"The underwood of the lots stated to be sold by the piece, and in lots the measurement of which is stated to be *actual*, shall be taken by the purchaser at the quantity stated. "Actual" measure means when the piece has been measured before, and the quantity is therefore known. The purchaser of each lot shall immediately after the sale pay to the agent of the seller a deposit of not less than 20 per cent., in part payment of the purchase-money, according to the estimated measurement, and give approved security for the payment of the remainder to the seller or his agent on or before the 5th day of May next, before which day all the lots, except the lots sold as actual and by the piece, shall be measured by the surveyor of the seller; and in case of non-payment of such remainder of the purchase-money on or before the said 5th day of May, the seller after such default (without prejudice to any other means for recovering such purchase-money) shall be at full liberty at any time to seize, retake, retain, and resell the said underwood, or if wholly or in part converted, the produce thereof, and wheresoever or in whosoever's possession the same may be, for making good the purchase-money, or such part as shall remain unpaid. If the remainder of the purchase money shall not be paid on or before the said 5th day of May next, the purchaser shall pay interest on the unpaid purchase-money from that day at 10 per cent. per annum. To the purchaser of such lot or lots as shall make immediate payment of the purchase-money, an allowance or deduction of sixpence in the pound on the amount paid, not including

the deposit, will be made, subject to final settlement when the lots are measured.

"All tillers and trees shall be carefully preserved and left uninjured by the purchaser, and if any such shall be cut or injured, the purchaser shall pay treble the value of the same. And all damages, with the expense of assessing the same, shall be paid to the seller or his agent within seven days after publishing the award of the referee, as appointed in the last condition. The purchaser shall leave uncut such a reasonable number of plashers as shall be marked or set out by the woodward of the seller, for which plashers the purchaser shall receive payment at the rate of sixpence per score. And the purchaser shall allow the seller, or his servants, to take, without making any allowance, so much underwood as shall be required for making good the fences.

"All the underwood shall be severed from the stem on or before the 25th day of March next, and the fagots and other produce shall be stacked by and at the expense of the purchaser in such places only, and not elsewhere, as shall be pointed out by the seller's surveyor, or by the woodward, on or before the 30th day of April next; and the whole shall be entirely cleared from off the lands of the seller on or before the 29th day of September next (except in certain specified lots which may remain until the 1st day of March in the year after next), or become forfeited to the seller. And in all cases the purchaser shall make use of the accustomed roads only, except only on occasions when any other road may be pointed out by the woodward. And all other new roads made by him or them will be accounted as wilful damage, and be assessed, and payment thereof enforced, according to the last condition.

"Upon failure or neglect of complying with the above conditions, the deposit money shall be forfeited to the seller, who shall be at full liberty to resell each lot or lots, or the goods converted from the same, either by public auction or by private contract, and the deficiency, if any, by such resale, with all charges attending the same, shall be made good by the purchaser at this sale, and be recoverable as and for liquidated damages.

"Lastly, all damages and other charges arising out of the infraction of any of the foregoing conditions, or any matter or thing relating thereto, shall be submitted to the sole umpirage of the auctioneers at this sale, or some person appointed by them in writing, such award to be binding on all parties. And such umpire shall have all the powers of an umpire appointed under the Common Law Procedure Act, 1852."

The Select Committee on the New Forest.

THE report and minutes arising out of this searching investigation were printed in 1875, and contain much that is of great interest to the forester. The report to the House is as follows :—The Select Committee appointed to inquire into and report upon the present condition of affairs in the New Forest, into the operation of the "Deer Removal Act," 1851, and particularly into the exercise and effect of the powers of enclosure given by that Act—have considered the matters to them referred, and have come to the following resolutions, which they have agreed to report to the House.

That the New Forest shall remain open and unenclosed, except to the extent to which it is expedient to maintain the existing right of the Crown to plant trees.

That the ancient ornamental woods and trees shall be carefully preserved, and the character of the scenery shall be maintained.

That powers of enclosure conferred by statute shall be exercised only on that area which has hitherto been taken in at various times, and been either kept or thrown out under the Acts 9 and 10 Will. III., c. 36, 48 Geo. III., c. 72, and the Deer Removal Act, 1851.

That the Crown should retain the power of keeping 16,000 acres of growing timber and trees, planted under the Acts of William III. and 1851, at all times under enclosure, and that the Crown be entitled to enclose and throw out at will any portion of the area over which the powers of planting are to be exercised with a view to its unrestricted use, in such manner as may be deemed expedient for the most profitable growth of timber and trees, but that the rolling power over the open portion of the forest, not now planted or enclosed under the Acts William III. and 1851, should cease.

That a nominal quit rent be charged by the Crown to the commoners for the exercise of the right of common during fence month and winter heyning; provision may be made, if possible, for the payment of such quit rent by some body representative of the commoners.

That the Verderers' Court be reconstituted, so as better to represent the commoners, and have power to regulate the exercise of the

commoners' rights over the forest, and to appoint officers to prevent encroachments upon them.

That all the rights of the Crown reserved under the Acts of William III. and 1851, except as it is herein suggested that they should be modified, be maintained.

That provision be made that, in event of any future severance of interests in the forest between the Crown and the Commoners, the limitations now proposed to be placed on the exercise of rights of the Crown should in no way prejudice the rights of the Crown.

The Hon. J. K. Howard, the Commissioner of Woods, having the management of the New Forest, stated that he considers the oak to grow much faster with the Scotch nurses, and with the regular system of planting, than it would if there were seedling trees scattered thinly over it. "There is no desire," he said, "to exclude the public, but we must exclude the commoners' cattle, and therefore we must lock the gates; if the gates are not locked, they go and turn their cattle in, and I think the best thing, in a national point of view, that the New Forest could be devoted to, would be that which it is devoted to now, the growth of timber. As for cultivating lands which average only 10s. an acre, you would not get the interest upon the outlay for drainage and farm buildings, let alone any rent. The proposal to remove the deer originated with the proprietors in the forest, who were put to great expenses by them; their crops were so badly injured, they were obliged to spend double what they otherwise need have done in fencing, and that led to a great deal of complaint. In the New Forest, the rights of the Crown are paramount over the rights of the commoners, that when the Crown kept deer there, it had the right of keeping unlimited stock, and of depriving the commoners, if it liked, of any pasturage whatever." Another witness spoke of the wretched condition of the deer in 1848, when the warden returned that they were only fit for carrion. It was argued in evidence that the commoners were benefited under the Act of 1851, in that they are relieved from the burden of the deer over their heads, whilst they have the rights of common preserved to them, and that it is unreasonable to claim a right of common for twelve instead of six months, because they are relieved from the burden of the deer, and that the Crown did not obtain a very substantial advantage, without giving up anything in return, by the right of planting on an additional area of 10,000 acres and that the right to keep deer was more valuable to the Crown than the right to enclose 10,000 acres. The value of the right to keep deer was estimated at 15s. per head for 3,000 deer; that is, at twenty-five years' purchase, upwards of £56,000.

Mr. John Clayton, timber valuer deposed, in reply to the question, "Do you not think that in old woods where there are intervals in

which trees leave open spaces it might be proper to plant trees wherever there was a clear amount of sky over the planted tree?" "My experience is that they never do well, and that they go what we call 'toppy,' and they never grow with a natural healthy growth as they would do if they were planted away from the shadow of the large trees; you may go to Kensington Gardens or anywhere to see what I state is the fact; there is not a single tree planted among those large trees which grows in what I call a natural or healthy condition. I cannot say that I think the trees have renewed themselves as they ought to have done, because there is not a single forest that I have had to do with that has had so small a quantity of timber on it as this one. In Hainault Forest there was £40,000 worth of timber upon 3,000 acres of ground. Mr. H. J. T. Jenkinson, county magistrate, said that the roads are getting into a dreadful state, and they ought either to be divided amongst the parishes on some system or other, or else some steps should be taken to keep them in repair, and that the Crown has no right to use these roads if it refuses to keep them in order."

The last evidence we have space to notice is that given by Professor Fawcett. "My strong opinion," he states, is that Parliament could scarcely adopt any policy which, even from economical considerations, would be more injurious to the people than the enclosure of all such waste lands. In no park have I ever seen the particular kind of beauty which is possessed by the New Forest. I certainly think that the Woods and Forests should administer this property as the nation desires, and that if the nation chooses that it should be used for purposes of recreation and enjoyment, rather than for profit, I think the Commissioners should use it distinctly for this purpose, and no more enclosures should be made in the forest. It would be as impossible, by an expenditure of money, to restore the New Forest, as it would be to restore a cartoon of Raphael's if it were once destroyed; the thing is gone for ever. Such are a few selections from the evidence culled from the blue-book, which deserves the careful study of all interested in the science of forestry, the conservation of the remains of our ancient forests, and the profitable uses of our commons and waste lands.

Bark Peeling in Herefordshire.

The peeling of oak in this county generally begins about the 18th or 20th of April, and although a start was made even before that date this year, owing to a long continuance of ungenial weather and harsh north-easterly winds, the stripping was by no means general until the second week in May.

Herefordshire being an important bark-producing county, a considerable amount of woodland revenue is derived from this source, and being of a superior quality is eagerly sought after by tanners and bark merchants, and can be sold in any quantity; large falls have annually taken place for a great number of years, and in consequence quantities have diminished, principally in the hedgerow class. This year, owing to diminished supplies and an increase in the price of other tanning material, prices have advanced about £1 per ton; £7 per ton of 22 cwt., delivered from the bark ranges to the rick, is being realized, £6 being the highest price last year.

For the information of foresters that store their bark, and afterwards chop and bag it, I may briefly state the system adopted here Having completed negotiations with the purchaser, and ascertained where he intends ricking, the bark as it is cured is loaded at the ranges, and delivered at once, 22 cwt. to each ton being allowed for shrinking weight in the rick, which is afterwards thatched. The most extensive buyer is Mr. Hugh Brown, tanner, Edinburgh, who has an agent in this district. The peeling here is, with few exceptions, done by piece work, prices ranging from 30s. to 40s. per ton of 22 cwt., the latter figure being for coppice bark. It has been suggested that opinions be interchanged as to the best method of peeling bark, whether by day wages or piece work. As I have had some experience both ways, I venture to say that in cases where a forester can give undivided attention to this branch of the work, day wages will suit very well, especially where ornamental plantations are to be thinned; the forester being always at hand, proper precautions will be taken so that no tree which is to stand shall be damaged by others in falling. This is one of the drawbacks on piece work, as it not unfrequently happens that in trying to do as much as possible, precautions are neglected, and a few boughs are broken from a tree that is to stand, which by a little forethought might be prevented. Our usual practice here, however, is by piece work, as on an estate where a large quantity of underwood has to be disposed of in different forms a forester cannot give the personal attention to the work which is necessary by day wages; in short, all our work here, if at all practicable, is done

by piece work. Another fact which favours peeling here by the piece is that, for the sake of the underwood, the oaks are severely thinned, which gives more scope for falling.

As to the best way of drying bark, it will be as well not to lay down a rule as applicable to all cases, as climate differs a good deal here from Scotland, and what is suitable for one place may not be the best in another under different circumstances. In the south of England I believe the prevailing custom is to drive in a row of forked stakes, laying a pole in the forks, making the range any length that may be required, and ranging the bark one end on the ground, the other leaning against the poles, making both sides equal, and the whole capped with large pieces to turn off the rain. This system admits a current of air to pass through the middle of the range of bark. When the weather is fine, coppice bark ranged in this way is frequently ready for the rick in eight days without having to be turned, which is a consideration not only in point of time, but bark when moved about in a half-dried state is more liable to spoil should rain set in. Another way is to lay a quantity of brushwood in a line, and pile the bark on the top of it, but managed in this way it never dries equally unless turned several times. Another method is to drive in a double row of forked stakes about 30 inches apart and opposite each other, laying a short piece crossways in the forks, and lengthways laying long poles, forming a sort of platform or stage. In this way the bark is from 2 to 3 feet from the ground, being laid about 18 inches thick all along the stage. In this way I have managed bark in Scotland very successfully, turning it once and covering with the largest pieces, but having tried this plan alongside the method first mentioned, I did not find any advantage, while turning was requisite and the range took more time to make, and I now adopt the first described method in preference.

It may be objected that the bark by standing with one end on the ground will retain the moisture, but I have not found that to be the case, and if rain comes, the water does not lodge in the bark so much as when laid in a horizontal position. In conclusion, I may state that we find it best to commence peeling whenever the earliest of the trees will peel, leaving the backward ones until another course. By so doing, hammering is avoided, and one hammered tree would mar the look of a load of bark, and if rain set in would be sure to spoil; and the time taken to get the bark off a tree that requires hammering may be set against the time occupied in going over the ground twice, while the bark will be got off in larger pieces, which is a consideration where large ricks have to be made. This year, owing to ungenial weather, the flow of the sap has up to this date been very unsatisfactory.

J. H.

The Forest of Salcey.

Salcey Forest, in the south-east part of Northamptonshire and on the borders of Buckinghamshire, appears to have been perambulated as early as the reign of Henry III. and Edward I., and from the official account given of the latter it appears that the limits of the forest had been extended by King John, but that the woods and lawns afforested by that king were disafforested by Edward. But though the forest was thus brought back to its ancient bounds, and though the limits thus established were brought to their original extent and confirmed by usage for more than 300 years, an attempt was made by Charles I. again to enlarge the forest, and a considerable extent of country was added to it, but the Parliament of 1641 again brought it back to its former dimensions. About the close of the last century the lands considered as forest, over which the Crown was possessed of timber and other valuable rights, extended in length about two miles and a half, and in breadth about a mile and a half, and contained 1,847a. 0r. 23p., about 1,121 acres of which were under timber. The Forest of Salcey was made part of the Honour of Grafton, erected in the 33rd year of Henry VIII., and in the 17th year of Charles II.; this, together with the Forest of Whittlewood, was settled on Queen Catherine for life, reserving all the timber trees and saplings for the use of the Crown, and at her death the Grafton family succeeded to her privileges. Among the papers collected by Sir Julius Cæsar (one of the ministers of James I.) is a survey of the timber and wood belonging to the Crown in the county of Northampton, taken in the year 1608, from which it appears that there were at that time growing in this forest 15,274 timber trees of oak, then valued at £11,951, besides 440 decaying trees, valued at £140 13s. 4d. The number of loads is not mentioned, but other documents of the period state that the general price of oak timber was then about 10s. per load, girth measure. The 15,274 oak trees, which were valued at 16s. each, must have contained, one with another, not less than a load and a half of timber, or about 22,911 loads girth measure, which is equal to 34,366 loads square measure. In 1783 the Deputy Surveyor of Woods and Forests reported that there were then in this forest only 2,918 oak trees fit for the navy (including all trees down to 30 feet of timber), containing by com-

putation 3,745 loads of timber, square measure, and only 194 scrubbed, dotard, or defective trees of above 30 feet each, besides browse trees, of which there were 8,266 oak trees, containing by computation 7,338 loads square measure, and 8,914 browse ashes; so that the timber fit for the navy, according to this survey, was little more than one-tenth part of the quantity fit for naval use in 1608. This falling off was not caused by felling during the last century, but to the ruinous effects of a mixture of opposite interests in the same property, and of the system of mismanagement. Some of the trees called browse trees, for instance, were found to be large and sound trees, fit for the service of the navy. These were lopped to feed the deer, and it is a significant fact that the salaries of the lieutenant and keepers were defrayed chiefly from the sale of browsewood. Again, the warden or deputy warden had the privilege of cutting bushes and underwood in the plains, open ridings, and lawns, and a better plan to prevent a succession of young trees could not be devised, as they need the protection of the bushes to prevent injuries from deer and cattle. The poundage of five per cent. on all moneys coming to the hands of the Surveyor-General, and another poundage on the expenditure of those moneys, made it to the interest of that officer to fell the timber and to promote and enhance the expense and repairs and works in the forest. The whole of the actual business of the forest used to be transacted by deputies, and these deputies not acting upon oath, the sales of the wood and timber being wholly under their direction, without any adequate check or control, and the deputies themselves being the buyers of the wood and timber sold by themselves, it needs no further comment to explain the difference in the above figures. These deputies must have had profitable berths, for after they had bought the timber of themselves, they undertook the execution of works and repairs, and were paid according to estimates prepared by themselves. Nor did the keepers go without their pickings, for they took the stools or roots of the trees felled, which must have put a considerable sum a year in their pockets, although such stools were the undoubted property of the Crown. In short, the administration of the forest seems to have been a merry-go-round of unblushing knavery. It was probably owing to the distance of this forest from the dockyards and the expense of carriage that no timber was brought from it for the use of the navy before 1781. The land carriage to the river Lea at Hertford, to which the naval timber from Salcey was generally conveyed, is fifty miles, and the whole expense of land and water carriage was £3 18s. per load square measure. This journey to the river Lea occupied four days, two going and two returning. The oak trees were divided into nine classes: 1. Wavers, being saplings of ten to fifteen or twenty years'

growth, produced from the former cutting of the underwood 2. Storers, being young trees above these ages, but not measurable as timber; 3. Trees containing from two to five feet of timber; 4. Trees from six to ten feet; 5. Trees from eleven to twenty feet; 6. Trees from twenty-one to thirty feet; 7. Trees from thirty-one to forty feet; 8. All trees containing above forty feet, except browse trees; 9. Browse oaks of all sizes. The ash was divided into three classes,—wavers, storers (as above described), and browse ashes. The soil of the district is admirably suited for the growth of large oaks, and in 1789 Mr. John Collingridge, who was instructed to make a report on the forest, writes :—"In the course of 105 to 130 years oak timber would grow there to a size fit for navy purposes. Trees fit for plank and thickstuff are never fit for those purposes in less than 100 years, and for the principal large pieces some trees may require 150 years. The navy timber bought at £1 18s. a load, as delivered at his Majesty's yards, is fully as cheap as any timber bought of the merchants. The growth and quality of the young timber now growing in the forest, and the fine large timber that has been felled for many years for the navy, is a general proof that the soil must be very proper for the growth of oak timber." This sketch would be incomplete without adding that in 1875 we find from the Report of the Commissioners of Woods and Forests that the total receipt from Salcey Wood was £596 15s. 10d., and the total expenditure for the same £397 11s. 4d.

Sale of Wood at Meldrum House, Aberdeenshire.

THE demand was good, and the prices realized were exceptionally high. Smokewood, for fish-curing, from 15s. to 18s. per ton; small spruce and Scots fir thinnings sold at 20s. per 100 pieces, average 12 feet in length and 2 inches in diameter at small end. Brushwood sold at from 1s. to 2s. 6d. per cart-load of about 10 cwt., and small ash from 1s. 9d. to 2s. 6d. per cubic foot. Current prices in the neighbourhood for manufactured wood of home growth are as under: ¾ in. sarking, spruce or Scots fir, 8s. 6d. to 10s. per 100 superficial feet; 1 inch flooring, 10s. to 12s. 6d.; beech boards, 11s. to 13s. per 100 superficial feet. Fence posts, larch, 5 feet long, and averaging 2½ inches diameter, 34s. to 40s. per 100; larch rails, 4 inches by 1¼ inches, 4s. 6d. to 6s. per 100 lineal feet; Scots fir and spruce, 2s. 9d. to 4s.; Scots fir and spruce fence posts, 20s. per 100 pieces, 5 feet long, 2½ to 3½ inches in diameter at small ends. Larch, small sizes in whole trees, 1s. to 1s. 6d.; medium, 1s. 6d. to 1s. 9d. per cubic foot. Manufactured, 1½ to 2½ inches plank, 2s. 6d. to 2s. 8d.; 2¾ to 3½ inches, 2s. 2d. to 2s. 4d. per cubic foot. The above are the average prices.

D. F. McKENZIE.

Spruce Timber.

By DONALD F. McKENZIE, FORESTER, MELDRUM HOUSE, ABERDEENSHIRE.

By way of corroborating Mr. McCorquodale's views on the durability of spruce timber under various circumstances, I take the liberty to state the following facts.

By the House, in the county of Aberdeen, was built about the year 1593, which date it bears, and some of the timber used in its erection was spruce, particularly the lintels of the windows, which are, so far as can be ascertained, all of spruce; and although they have stood in a rather humid locality for nearly three centuries, they are still in good condition. In the same locality, but of much later date, are buildings in which I find the same kind of timber used, and which is yet quite sound, and in such a good state of preservation that it bids fair to see several generations pass away without being much the worse. On examining the wood I found it very hard and close-grained. I have no means of knowing where the wood was obtained. The oldest of that class of fir on the estate is about 130 years. The wood seems to have been roughly hewed with an axe or adze. In the same building Scots fir is also used, some of which is of very good quality; although of small dimensions the trees were sound and well *hearted*, but the portions of *sapwood* still left are completely riddled with insects, although very few marks of insects are found on the spruce timber. On this estate there are outhouses built of spruce fir, some of which are about forty years old. The posts and bars are of larch and Scots fir, but all the outside linings are of spruce, and except where in contact with the soil the wood is yet perfectly sound, and the only painting it ever got was a few thin coats of coal tar. Long ranges of fences, composed of larch posts and spruce bars or rails, which were erected more than twenty years ago, are still in a fair state of preservation, but are now beginning to require a good deal of repair, not so much on account of the bars, as the posts rotting and breaking over at the surface of the ground. The rails were sawn from small spruce trees of from fifteen to thirty years old, slightly slabbed, and stripped of their bark. The wood got no paint of any kind, and except where nailed to the post or stake it is as sound as when erected, and much harder. I may add, however, that these fences are in sheltered situations, which would account to a good extent for their durability.

One instance more, and I shall have done. Some years ago I had to remodel the water-troughs of a saw and thrashing mill which was erected in 1838. The greater part of the timber employed in the erection was spruce fir. The upright pillars and cross-beams were of larch, while the planking and longitudinal beams were of spruce. The larch pillars were almost completely decayed, except small pieces of heartwood occasionally met with; the cross-beams were of larger timber, and contained more heartwood, and in consequence were in a better state of preservation. The spruce beams, however, were sound, except at the joinings, which seemed to have been made without any proper preparation. These pieces I had cut off, and re-erected them on new pillars, where I expect them to last twenty years yet. I could give many more instances of the durability of spruce timber, but those quoted will suffice.

Some Notes on British Forests.

An old Parliamentary Report inquiring into the state and condition of the woods, forests, and land revenues of the Crown, and dated 25th January, 1787, gives us some interesting particulars; as, for instance: to render the terms lop and top, cordwood, and kibbles, intelligible to those who may not be accustomed to them, it may be proper to explain the signification they bear in the account of the perquisites of the deputy-surveyor and keepers.

Lop and top is that part of the stem or body of the tree, stripped of the branches, which in navy timber is cut off by direction of the purveyor, as unfit for naval use; and in stolen timber that part which the thief either voluntarily leaves behind him, or has not an opportunity of conveying away. It frequently happens that these tops contain timber fit for carpenters' or coopers' uses, and sometimes knees and crooked timbers fit for small vessels, but very rarely for king's ships. When they are unfit for any of these uses they are cut into cordwood.

Cordwood consists of the boughs and branches of trees cut into pieces a little over two feet in length, and generally about the thickness of a man's arm. Where the branches happen to exceed that thickness they are cleft into two or more pieces to reduce them to that size, in order to be made into charcoal. A cord of wood is a pile of these pieces of the exact dimensions of 8 ft. 8 in. long, 4 ft. 4 in. high, and 2 ft. 2 in. thick, which lastis the length of each piece.

Lop, crop, and *offal* have all the same signification, viz., the boughs and branches of trees, and all are made into cordwood, but the cordwood of naval timber is made from the whole lops or branches of navy trees, and that arising from miners and stolen timber only from the boughs and branches left by the colliers or timber stealers, and the wood so left is termed "offal wood."

Kibbles are stolen pieces of timber cut into suitable lengths for cider casks and for wheelwrights.

The following answers were given by different witnesses with respect to the question:—"Whether the general consumption of oak timber for building or other uses is increased or diminished; and to what cause in your opinion is such increase or decrease to be imputed?"

Bedford—Diminished, in consequence of the scarcity of oak, and the use and utility of deal. Berks—Fir timber used instead where it will answer the end. Cambridge—The consumption for buildings very small, both on account of the scarcity of oak and the cheapness

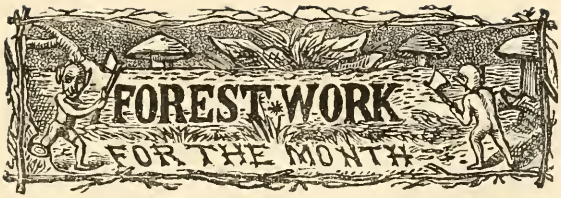
of fir timber; all old buildings built of oak, a proof that it formerly abounded in the county. Chester—Certainly diminished, and principally on account of the large importations of deal timber at Liverpool which is carried to most parts of this county, at a small expense, by canals. Cornwall—Increased, through the present taste for building new houses and improving farmhouses and offices. Derby—The consumption of oak timber for building within this county is altogether diminished. The additional price of oak—nearly doubled within these forty years—arises from two circumstances: the decrease of the woods and the alteration in the farming of land. Devon—The use of oak for building or repairing farms is nearly as it has been. In general, oak is only used where elm would go to decay, as oak is double the value of elm. Fir timber is mostly used in building and repairing good houses. Another report states that the supply is diminished, owing to its not being properly encouraged. Dorset—Decreased in building. Durham—Fir timber is generally used in building, and is imported at Stockton, Sunderland, and Newcastle; and little oak used for that purpose, fir timber being much cheaper. Essex—Diminished in consequence of the increased price. Gloucester—Owing to the universal use of deal in the generality of buildings, the consumption of oak is certainly not so great as it was. Hants—The consumption of oak in house building is much lessened, from the general use of fir timber. Hereford—Oak more scarce and valuable. Stone and brick are used where formerly timber was. Hertford—Oak is the timber generally used in this county, and no other timber will answer the purposes to which it is applied. Beech has been used, but unless the soil is remarkably dry the damp causes the planks to rot very soon. Kent—The use of oak is lessened by the introduction of fir. Lancaster—Use diminished, fir being cheaper. Lincoln—It is believed that the consumption of oak timber is in a small degree increased, owing to the increased value of fir timber from Norway, &c. However, a second report states the reverse, and states as a reason that the trees have not come to their growth, and that fir is used to supply the deficiency. Monmouth—Sale diminished, fir timber being obtainable at a much lower rate. Northumberland—Chiefly supplied coastwise, and by foreign oak timber. Nottingham—Increase; cause, the increase of manufactures. With more probability of correctness, other reports state a decrease, owing to the low price of fir timber, and other causes. Oxford—Increased, owing to the many additions to buildings and enclosures in the county Rutland—Much the same. Salop—Increased, owing to the erection of a great number of public and private buildings. Somerset—Decreased, owing to the use of deal and elm. Stafford—Decreased, owing to the great importation of deals. Suffolk—Uses

restricted, owing to the high price, and also from the increased use of fir; and for the remaining counties it may generally be said that to the introduction of fir may be attributed the falling off in the consumption of oak. That the true principles of forestry were not generally understood in those days no one can doubt; that a better system will in future prevail there is every reason to believe.

New Roots to Old Trees.

THIS seems a startling idea, but it is the subject of a communication from Mr. J. Common, Denwick, Northumberland, on the 6th March, 1843, to the Society of Arts, and for which he received the silver Isis medal. He says, "The plan of putting new roots on trees, and taking away all the old ones, is of great utility, for I know by experience that trees are often engrafted on, which, on account of their roots, will not allow the trees to bear the proper quantity of fruit. And the plan of putting new branches on espalier or wall trees is also of great utility, as a branch is often wanted to finish the tree. This method of engrafting may be done at any time between April and August, and either with the present year's wood or with wood of several years' growth. The mode of effecting the addition of a branch to some particular part of the stem is by bending a branch either from the same tree, or from some tree near to it, and inserting the end thereof behind the bark, which is properly cut to receive it, and then tying it carefully round with string; and it is more certain of taking hold or growing than by any other way of engrafting or budding; and as certain, or more certain than any other way of inarching." Two specimens of Mr. Common's mode of adding branches, and two other specimens of adding roots, were placed in the society's repository, and are thus described:—"The first specimen shows how a bud or a branch may be put on, and is without any growth, being left loose in order to exhibit the first part of the operation. The second specimen has had one summer's growth. The branch should be cut either with a small branch near to its upper end, or a bud in the same place, to become a branch, and great care must be taken in tying it on. Neither mud nor clay is required to protect it from the weather; as the swelling of the tree commences the ties must be carefully removed. Specimens three and four are to show the mode of adding a root to an old tree,—the former pointing out the plan of operation, the latter showing one year's growth."

The mode of proceeding in this novel operation, if the tree be small, is to plant a small tree close to it, inarching it by bending it over to the original tree and tying it round as before. The planting of the new tree should be done in the spring before the year in which the inarching is performed; and when from sufficient growth it has firmly taken hold, the old root may be taken away. If the tree to be underpinned be of large size, several small roots are to be planted around it, each inarched. When the new roots have strength to carry the tree, the old ones must be taken away by degrees, care being taken to make an incision all round the bark.



In consequence of the cold, wet, unseasonable weather which has prevailed during the greater part of April and May, the bark-stripping operations throughout the country have been thrown back at least fourteen days later than the average. It is a consolation, however, to remember that the bark is better on the trees than lying rotting perhaps on the stands ; and it is quite certain that with a genial warmth there will be a very rapid flow of the sap, necessitating the utmost dispatch on the part of the forester to secure the bark before it clings to the tree. From a variety of causes bark is likely to be a dear commodity this season, and foresters should improve their opportunity by asking good prices. We hope to see the subject of pruning fully discussed in these columns, as we know there is a great diversity of opinion upon the subject, both as to the time and manner in which this important work should be done. Hardwood pruning should now be proceeded with, however, and where it is necessary to take off dead or other branches close to the bole of the tree, the cut should be made exactly where the bark of the tree ends and that of the branch begins. By a little attention this point can soon be found out. If the cut is made too near the trunk the most unsightly wounds are produced, which take double the time to heal over, and often result in permanent injury to the tree.

The heavy fall of snow in November last year caused great damage to forests in various parts of the country, oak plantations in particular being very much broken down ; and the foregoing simple rule should be observed in the removal of twisted or broken branches where not already cleared away. The tarring or varnishing of wood or iron fences should be proceeded with this month, and if possible should be done in warm sunshine, as the iron or wood being slightly heated, it absorbs the tar more readily, and consequently is better fitted to ward off the attacks of rust or decay. The workmen are also able to perform the work more expeditiously, for when tar is once heated on the fire it retains the heat much longer in warm weather, thus enabling the men to go on almost continously with their work, instead of having frequently to wait for the tar to get heated, as is the case in cold weather. All grass, nettles, and other weeds should be carefully cleared from under the fences, so as not to interfere with the tarring of

the lower rails, and all posts or iron standards which run down into the ground must have the earth scraped away, to allow them to be thoroughly tarred to a depth of at least three inches below the surface level of the ground. The earth should not be put back for a few days, till the tar is quite dry and hard, when it should be filled in and firmly trodden with the foot. That part of a post or standard just where it enters the ground is the first to rot or rust from the combined action of air, earth, and moisture, and this therefore is the part which should be most carefully tarred, although it is far too commonly neglected.

Clean hedges, and see that all fences are in good order to resist the encroachments of cattle. Clear out open drains, and cut down the weeds on their edges before they run to seed.

If the weather is dry, all seed beds in the nursery should be carefully attended to with water, as nothing prevents a healthy growth of the young plant so much as a parched state of the soil when the plumule is pushing through the surface. Never allow the seed beds to be overrun with weeds. Pull them out as soon as they can be handled. When once weeds are allowed to shed their seeds, it takes years to get the ground clear of them again.

See that recently planted trees and shrubs are not suffering from want of water; and give a thorough drenching when it is necessary to apply it, and also see that all are securely staked against being swayed about by the wind.

Look over plantations and mark the timber trees to be felled during the next autumn and winter; as the trees can be better selected at this season when in full leaf, and those marked which show signs of maturity or failing health, and where they are too thick and overcrowded. In growing plantations always *leave the best* trees to grow on into large and fine timber.

SCHOOLS OF FORESTRY.

SIR,—In my pamphlet on "The Schools of Forestry in Europe which you did me the honour to notice at such length in the first number of the *Journal of Forestry*, I submitted a plea for the creation of a school of forestry in connection with the projected formation of an arboretum in Edinburgh. My opinion, that at comparatively little expenditure there might thus be created a school of forestry which might take its place with the best equipped schools of forestry on the Continent, remains unchanged. Whether any such arrangement as I have suggested will ever be carried into effect is quite uncertain. Meanwhile the field is open for any educational institution to take the initiative, if so disposed. I have in my former communication intimated that the measure might be carried out in combination with an agricultural college, such as I suppose that at Cirencester to be. This is done at St. Petersburg and at Moscow, in Russia; at Nova Alexandria, in Poland; at Thavand, in Saxony; and at Hohenheim, in Wurtemburg; and in illustration of what might then be done I have forwarded you an account of the system pursued at this last-mentioned place; and this I do, not as indicative of any idea being entertained by me that we have only to adopt the same arrangements and the thing will be done, but as a means of facilitating the idea of how a course of instruction in forestry might be adapted to and combined with existing arrangements in any such college, as I have in my plea for the creation of a school of forestry in Edinburgh endeavoured to show how it might be adapted to and combined with existing arrangements for instruction in that city without in any way disturbing these.

Haddington, May 18, 1877. JOHN C. BROWN.

THE POPLAR TREE.

SIR,—Permit me to congratulate you on the appearance of your first number, which I have no doubt will be, or has been, welcomed by a great many who, like myself, cannot pretend to be foresters, and yet have often occasion to seek information connected with the science which the establishment of your journal, supported by such a strong phalanx of professional contributors, will now enable us to obtain.

What is new to me in the pages of this first issue relates chiefly to the poplar tree, of which there are many varieties, but the *black Italian poplar*, which is of very rapid growth, is put before us in your pages as a *valuable timber tree*, and I have read with much interest the account of it furnished by Mr. McLaren, of Hopetoun (at p. 9).

Hitherto I have regarded this tree as rather outside of the forester's catalogue—a weedy, presumptuous aspirant, of very little use, and less ornament—perhaps from its being chiefly found planted in *hedgerows*, and shooting up with a kind of impudent indifference to the manner in which it associates itself, as to effect and keeping, with the surrounding landscape, as if disdaining to be classed with trees of less lofty but more substantial pretensions, and delighting to look down on them with supercilious contempt. But Mr. McLaren redeems it from these derogatory charges, and exhibits it in quite a new and agreeable light, till we can almost fancy it destined to replenish Great Britain with building timber when the pine forests of America, from which we now derive a large portion of our supplies, are exhausted—a consummation which it is confidently predicted will occur, at their present rate of destruction, within the next ten years.

However, there are two or three questions which occur to me that perhaps I may be allowed to put through the medium of your columns. I have never met with poplar among marketable timbers, either native or imported, for building, agricultural, or other purposes, such as machinery, mill-work, or furniture, nor do I know what speciality it is adapted for. Yet Mr. McLaren informs us that a tree of this species, containing 80 cubic feet of timber, sold for £8 12s. 6d. where it was cut down, in Linlithgowshire, in December last, which sum is considerably more than a balk of pitch pine of the same contents, well squared and delivered ready for use all the way from Pensacola, would fetch on the quay of the neighbouring port of Grangemouth. The inquiry naturally arises, What are the particular excellences of poplar wood to entitle it to this preference ?

I am aware there is a valuable wood in Canada known to commerce as *hacmetac*, which is, I believe, a species of poplar used in ship building, and so much esteemed that it entitles a vessel timbered with it to a higher class at Lloyd's than almost any other wood, not excepting the oak of that country. But whether we have this tree among us in Great Britain, and what its habits of growth may be, I do not know. Some obliging forester on the other side of the Atlantic will perhaps favour us with a description of this tree as it appears at its maturity in its native land.

Again, I have always supposed the tall straight and fast-growing poplar to be a *soft* wood, but Mr. McLaren classes it with *hard* woods. Perhaps it hardens in seasoning, like alder, a poor brittle tree when growing, but tough enough when converted to broom, mop, and light implement handles. On cutting down a green young poplar tree some four or five inches in diameter and thirty feet high it seemed like chopping at a Swede turnip.

In America they say it takes a hundred years to produce a pine tree that will yield a piece of timber a foot square and fifty feet long, or a load of

timber; but according to Mr. McLaren we can grow a more valuable tree in about fifty years, in this country, with more than a load and a half of timber in it. Will he kindly give us further information about it, especially as to the purposes for which it is chiefly employed?

In the useful Table of Values which you have given us at page 31 of your Journal, I observe that poplar, in the ordinary way and in the midland counties, fetches about the same price as beech, rather less perhaps, but it jumps up all at once in the solitary instance of Linlithgow to 2s. per foot, and drops in the case of Denbighshire to 10d., as also in Norfolk and Suffolk. Probably this wide difference has something to do with the size of the wood as well as the quality.

Among other kinds on my own little property is a single row of these poplars, planted fifteen years ago as a screen. They are now forty feet high, and seven to nine inches in diameter at a height of ten feet from the ground. They are about three feet apart, and instead of 70, at least 700 of them might easily be raised on an English acre, with plenty of room for ventilation, and even for traffic between them, to be thinned, if needful, in thirty years' time. There are other varieties of the tribe around, such as the balsam poplar, now in bright green leaf, a branching, large-leaved, and not very tall-growing tree, and the more elegant aspen, with scarcely yet a bud showing at this unusually late date, the 9th of May.

If poplar wood is of value, I imagine plenty of it may be got cheaply in France. All the way from Quillebœuf to Rouen, the banks of the Seine are chiefly fringed with poplar, till the eye wearies of them. As seen from the river they often intercept the view of the open country beyond, and from their great height they make the oak woods in the background look poor and stunted till you get in among them.

I am not aware that poplar has either resinous, pitchy, or turpentine properties in its sap, but the sprigs or chippings, even when scarcely dry, are very combustible, and make good kindling.

I shall be glad to hear more of the virtues of the poplar tree, and in what "constructive work" its wood is "much used" in this country; and as science is never more happy than when employed in imparting instruction to the unlearned but willing student, I am sure your contributors will not only pardon my intrusion among them, but also kindly enlighten the perhaps not inexcusable ignorance of

An Amateur.

Near Old Oak Farm, Middlesex,
9th May, 1877.

BATTING MATERIALS.

Sir,—In the *Journal of Forestry* for May, reference is made to the deleterious effects of batting iron standards with sulphur. I believe it will be somewhat difficult to say whether the effects referred to are caused by electric or chemical action or both. At the same time it is a well-known fact that brimstone is a highly electric agent, and may possibly

accelerate the oxidation where it comes in contact with the iron, much in the same way as the decomposition of certain metals takes place when in contact with each other.

I may here remark that I have been in the habit of using what is termed "Lava," instead of the common mixture of brimstone and sand, which, if not of the proper proportions and the proper quality of sand, is a very unsatisfactory compound for fixing iron standards. Indeed, I was lately more than astonished to find that some extensive fence manufacturers use this worthless compound (sand and brimstone), and were quite unaware that such a thing as lava was to be had.

The advantages of lava are that the compound is to be had ready made, that is, it requires no mixing or preparation other than being melted in a pot. It sets at once, as hard as a whinstone, and a more effective batting material I have not seen. I am not aware what the compound is made up of, but it is very like slag from an ironstone furnace, and doubtless brimstone enters largely into its composition. It may naturally be inferred that this "lava" is just as likely to be injurious to iron standards as the common brimstone mixture. However, I do not think so. I have just made an inspection of some iron fencing erected four years ago on the top of a stone dyke, the standards of which were fixed with "lava," and I can find no apparent injury from the contact of the lava with the iron. Of course the fence had a coating of coal tar after being put up, and another coating about two years ago, which may have somewhat averted the injurious consequences.

It occurs to me that the injurious effects of brimstone may be aggravated by the iron standards being allowed to rust from want of paint or from an imperfect coat of it. It is very easy to understand that if iron standards are allowed to oxidize or rust, the metal will become gradually thinner, especially if in the neighbourhood of the sea air, and form a cavity or receptacle for every shower that strikes against the fence, thereby increasing rust and hastening decay, the best preventive against which is a regular system of painting with the best materials, care being taken that the work is properly executed.

In fastening or batting standards, whatever kind of cement is used, there should be no cavity left round the neck of the standards, but all should be properly filled up and carefully smoothed over, and the fence kept properly painted, *not only what is seen*, but also that which is *immediately under the surface*. Iron, like wood, is most liable to decay between the wet and the dry.

JAMES KAY,
Forester.

Bute Estate, Rothsay. May 14th, 1877.

A FRIENDLY CRITICISM.

SIR,—Having received the first number of the *Journal of Forestry*, allow me to congratulate you on its success, as, owing to its style and manner of treatment of its subjects, I think there is every prospect of a bright future in store for it. I shall not in the least try to review the contents, as

I should fall far short of the mark, but in the form of a letter I shall make a few brief remarks. I do sincerely hope that each and every one of we foresters will bestir ourselves, and do what we can in contributing to its pages, both practically and scientifically, as far as our abilities and opportunities will permit, thereby adding our mite towards the advancement of knowledge and the interests of our craft. In the introductory notes everything is so full and comprehensive that even the greatest critic would be at fault, should he contemplate the idea of adding or diminishing therefrom. No doubt of late years the science of forestry has made rapid strides in the way of advancement, and a long-felt want is now supplied by the *Journal of Forestry*, which will be the medium of communication whereby all interested in the science may concentrate and utilize their practice, thoughts, and ideas. The *Journal of Forestry* being still in its infancy, no one can even imagine what the ultimate results of its influence and instruction may tend to produce; indeed, the conservation of timber is of primary importance, as it supplies an infinite number of man's wants. We may say that the love of trees forms one of the deepest and earliest impulses of human nature; in fact, its unwritten history is coeval with man upon earth. We have great reason to be thankful for the help afforded by the Scottish Arboricultural Society in the advancement of scientific knowledge, and with the monthly *Journal of Forestry* we can easily picture to ourselves a rapid improvement in the principles and practice of arboriculture.

It has been truly said that the one-half of every well-spent life has been devoted to acquiring facts, and the other half to making use of them; but to draw the line of demarcation between these two periods of man's life would be a difficult problem to solve. Now as none of us can tell how long we may be *fruges consumere natus*, he certainly does well who not only uses, but imparts facts as soon as he is certain they are correct. If we look at the area over which the skill of the British forester extends, we find its extent, both in its geographical range and its physiological aspects, to be indeed very great. Each geographic province or zone has its appropriate flora, from the high water line of tidal seas to the lower line of perpetual snow on the loftiest mountain-ranges, where the scrub of the *Ghor* is washed by the eddies; aye, even to the flowing torrent of the Jordan, the bed of which is said to be fully 1,000 feet below the surface level of the Mediterranean Sea.

Continuing my remarks on the contents of your first number, I come now to the editorial notes, in which it is justly said that British foresters and the Government may well be ashamed of the feeble attempts they have made to promote the interests of their portion of the national industry; but the time has now come when every forester must put his shoulder to the wheel, and endeavour to do his utmost to raise himself and his profession into the highest ranks of scientific and practical industry. Of the summer operations beneficial to woodlands much could be said, but the very able paper by the late president of the Scottish Arboricultural Society comprehends nearly everything, and, like the introductory notes, leaves little if any room for comment. In the selection and marking of trees to be removed or

felled at the proper season, the writer always adopts this method of marking them in summer, especially among hardwoods. Now as to the beauty of expression, it is much more easily imagined than described; and should we try to do so we should fail in the attempt, as it taxes the ingenuity of the cleverest artist to depict Nature in her unmolested grandeur. To discuss the beneficial influence of trees and their effects upon the climate, temperature, and rainfall of a country would indeed open up a wide field for discussion, but whether it be for the love of trees, or because they are the grandest products of the soil, I don't know, but the due appreciation of the benefits derived from trees is growing more and more amongst our tenant farmers in this northern country, and there are very few of the more prominent ones who do not now contrive to spare a piece of land and devote it to growing a small forest of their own. While looking over the table of prices realized for timber, I marvelled exceedingly to see that the highest prices were obtained in Banffshire. My experience in Banff and Aberdeenshire leads me to say that in the present depressed state of the market "no such prices exist." I have, on making proper inquiry, the authority of five different wood merchants and two foresters to say so. Indeed, one of them bids me say that if such prices exist at Cullen he can deliver £1,000 worth, and more if required. About ten days ago I saw some oak sent to Banff for 2s. 2d. per foot, going within a short distance of Cullen. I quote the average prices as I got them from these wood merchants, all timber being of the best quality, viz., larch, 1s. 9d. to 1s. 10d.; Scots fir, 1s. 1d. to 1s. 2d.; spruce, 10d.; ash, 2s.; elm, 2s. 6d.; and oak, 2s. to 2s. 2d. per cubic foot. Lately I also saw the invoice of some elm, delivered at Banff, carriage paid, from Perth at 2s. 6d. per foot, first-class heavy timber. Having sold several hundred pounds' worth of timber this season (but not at Cullen prices), I was very anxious to ascertain the true state of the markets, after seeing such extraordinary prices mentioned, and from the inquiries I have made I have not the least doubt but the parties will write themselves to contradict such prices. Of course I do not dispute but such a price may be got for a particular tree, but then that is no rule as to the general average of prices in a district, and ought not to be given as such.

Should any proprietor see these prices and ask the question of his own forester, "How is it that you cannot get such prices for your timber as they get at Cullen, and only a few miles distant?" one would be reluctant to say, "No such prices exist." I lately asked a shipbuilder what prices he would be willing to give for first-class larch and Scots fir delivered of the very best quality, some of the larches containing over 30 feet of timber. He replied, "I will not give one penny more than 1s. 10d., as we can get any quantity as good as yours at that money."

As to spruce timber, I can corroborate Mr. McCorquodale's remarks, so far as my own experience is concerned, but that is limited as compared with his, yet several instances may be adduced. Over twenty-five years ago my uncle roofed one of his byres with spruce timber, and when I saw it last, two years ago, it was quite sound. As to Roman cement for batting the standards of iron fences, I never tried it, but having a large extent of iron

fencing to erect I should be glad to know if the cement in this case would prove as beneficial as lead. I have always been opposed to sulphur or batting in iron standards for fencing.

In conclusion, let me second Mr. Scott's suggestion, viz., that the *Journal of Forestry* be both comprehensive and exhaustive, then it cannot fail to be both interesting and instructive so long as we continue to give in faithful and judicious reports.

ANCORA IMPARO.

THE OAK BARK SEASON

SIR,—In accordance with the request contained in your last number I send you a few particulars of the prices realized for timber and bark, rates of wages paid, &c., on this estate, with the hope that they may call forth further remarks on this important subject.

For felling and peeling oak timber I give 25s. per ton of 2,464 lbs., or 22 cwt. to the ton of oak bark, loading and trucking the same ourselves; when the loading and trucking is done by the men who take the work the price is 30s. per ton, but I find it much better to load it ourselves, as taskwork men generally will not be careful enough in loading to see that it is in good condition. It is also important that when peeled the bark should be stacked on wooden horses, or stages, standing on forks 2 ft. 6 in. from the ground, and care should be taken not to overcrowd the stages; the long bark should always be put on the top to protect the other from rain, as bark very soon spoils by getting mouldy and spotted and black in wet weather.

This season so far has been a very good peeling one. I have delivered and trucked at the railway station over 40 tons already, and shall have about 70 tons more to deliver before the season is over. The price realized this year is £7 per ton of 22 cwt. For felling all kinds of hardwood I give 1d. per foot, only paying for measurable timber. Should any tree turn out rotten and bad I generally allow the men a sum for felling it, but this circumstance rarely happens here. Care should always be taken in felling timber to get well down in the spurs, or large roots, which are often the most valuable parts of the tree. For cutting and ranking cordwood I give 2s. 9d. per cord: the size of the cord is 8 feet long, 5 feet high, and 3 feet wide, closely ranked.

We also cut many "chocks," for colliery purposes, the sizes of these being 5 and 6 inches square and 2 feet long. For cutting these in the wood I give 9d. per dozen. They have then to be taken to the saw-mill and squared, from there to the railway station and put into trucks; the price being 6½d. to 7d. each. By doing this the proprietor realizes a better price than by cutting the large short pieces of cropwood into cordwood, as cordwood now is a dull sale, only making 10s. 6d. per cord for hardwood, owing to the bad state of the iron market.

The prices here for oak timber are from 2s. 6d. to 1s. 6d. per foot, and 1s. for loose tops, an exceptionally fine tree or so fetching 3s. per foot. Trusting these few statements will call forth a still further supply of information on the abovesubject,—I am, Sir, yours faithfully,

RICHARD JANDRELL,
Forester and Bailiff to Viscount Hill.

Hawkstone, Salop,
May 14th, 1877.

GENERAL REMARKS.

SIR,—Unfortunately I do not possess a facile pen, and cannot convey my ideas to your columns in graceful metaphors and flowing periods like some of your contributors. An experience of nearly forty years in surveying, marking, and valuing timber on some of the principal estates in the midland counties must nevertheless have been badly spent if I have not gained information which may be useful to some at least of the readers of your valuable Journal.

I have been much pleased in perusing the capital article on "Summer Operations Beneficial to Plantations." I now only wish to refer to that portion which relates to pruning. I observe a practice adopted which is offensive to the eye and injurious to the tree on many estates. I refer to the plan of cutting off considerable limbs of trees at a distance of from two to three feet from the trunk. Now if the forester instead of this unsightly mutilation would judiciously prune the branch so as always to leave a living and tapering end to it, he would gain all the advantage of light and air which he requires without destroying the beauty of the foliage.

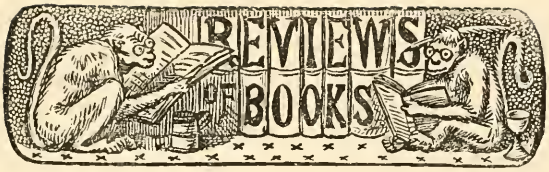
I should be glad to see some remarks from practical men on the cultivation of the abele poplar, as this species thrives well on marshy land, and grows as rapidly as the black poplar, whilst its wood is by many merchants considered superior to any of the poplar species. Mr. Berry, of Horningsham, should be able to give us some interesting particulars on this subject, as I saw on the Longleat estate some remarkably fine specimens in the year 1868, and was informed that five abele trees had been blown some time previously, containing respectively 550, 661, 660, 660, and 690 cubic feet.

With regard to your article on hop-poles I beg to say that a good supply may be obtained from the thinnings of larch plantations, but these should always be peeled, as the bark will pay the cost of workmanship, and the poles will be much more durable and lighter for carriage.—Yours truly,

Bridge House, Brimfield, May 21, 1877. WM. MAINWARING.

PRICES FOR SAWING.

SIR,—I should like to have the opinion of some of your practical correspondents as to what are the usual rates paid for having fencing material manufactured by contract; such as the rate per hundred for sawing four and a half and five feet stobs, likewise the rates for sawing paling rails, and the general custom as to any slabs or refuse that may be made in sawing, whether they belong to the saw-miller or the party having the wood manufactured. FAIR PLAY.



Transactions of the Highland and Agricultural Society. Fourth Series, vol. ix., 1877. Edited by FLETCHER N. MENZIES, Secretary to the Society. Edinburgh: Messrs. Blackwood and Sons.

The transactions of this the leading and most influential society in Scotland for the improvement of rural affairs always contains much valuable information upon the subjects which it is its peculiar duty to foster and promote, as well as upon many other branches of rural industry that come within its comprehensive scope of observation and encouragement. The present volume is fully up to the average in interest and usefulness. It opens with a report "On the Agriculture of the Counties of Edinburgh and Linlithgow," by Thomas Farrall, Aspatria, Carlisle, who gives in his introductory remarks a short description of the leading features, area, and population of these two far-famed agricultural counties. Noticing the rise and progress of their agriculture, from the rude and primitive system of husbandry in the thirteenth and fourteenth centuries to the complete and elaborately worked out system in vogue in the Lothians at the present day, he remarks, that "within the present century agriculture both in Mid and West Lothian has advanced rapidly in draining, in the deep culture of the soil, in the extended use of machinery, in the introduction and appliance of steam power to many of the most laborious offices of the farm, in the use of extraneous feeding stuffs and artificial manures, in the scientific knowledge possessed by the leading farmers—in a word, almost everything pertaining to the satisfaction of the proprietor, the prosperity of the farmer, the happiness of the labourer, and the welfare of the community at large as meat and bread consumers."

After a few well-chosen particulars about the climate and soil, he proceeds to give an account full of interest of the rotation of cropping followed, the different descriptions of grain, hay, grass, and green crops cultivated, naming the most popular sorts; stock breeding, rearing and feeding, dairy and sheep farming, horses, pigs, dogs, and poultry. The improvements in the agriculture in the district during the last quarter of a century receive due attention, and also the condition, remuneration, and housing of the farm labourer, all of which have greatly improved during the period. The total number of farms in Mid Lothian, over 50 acres, is 1,012, the average extent of each being 131 acres. There are 120 farms of over 300 acres. In Linlithgowshire there is a total of 542 farms of 50 acres and upwards, the average being 108 acres, 35 farms being over 300 acres.

The rent of land has increased 25 to 30 per cent. in Mid Lothian and 20 per cent. in Linlithgow in the last 25 years. Fences, draining, roads, and cultivation by steam are shortly noticed, and the important item of "woods" and "nursery grounds" are treated with curt recognition in less than a dozen lines containing nothing worth quotation. "Farming, Past and Present," receives, as it deserves, a lengthened description of much interest; and the paper closes with a glance at the "Other Sources of Industry"—mines, quarries, manufactures, fishing and shipping interests; rendering the report comprehensive enough, but the whole has been treated in such a manner that it might easily have been extended to a goodly-sized volume with advantage, and without at all exhausting the subject.

In a full and very interesting report "On the Agriculture of the Counties of Ross and Cromarty" James Macdoual, Aberdeen, treats the subject in an able and perspicuous manner, giving a mass of details and facts well worth the perusal of all interested in agriculture. Speaking of the woods and forests, he says, "A premium is at present offered by the Highland and Agricultural Society for a report on the woods and forests in Ross-shire, and therefore many notes on the subject here would be out of place. It may be remarked, however, that the breadth under wood in the county is very great, and that many thousands of acres have been added to it during the past ten or twenty years. Wood seems to thrive exceedingly well in the county, and is found to be a most remunerative speculation. One instance of this may be given. A plantation on the estate of Tulloch was recently disposed of, and the sum realized was equal to a rent of £2 per acre for each of the forty years the wood occupied the ground. The benefits conferred on a cold late district by plantations are known to be considerable; and in these days of dear labour and high prices for wood the landed proprietors in some of the other counties in the north of Scotland would do well, both to themselves and the community generally, were they to copy the good example shown in the way of planting by the proprietors of Ross-shire. There is one little point, however, that the proprietors in Ross-shire would do well to look to in the interests of their valuable plantations. That little lively creature, the squirrel, is well known to be a destructive enemy to young trees. It gnaws away at the 'leaders,' and in this way a single squirrel has been known to kill or greatly damage no fewer than a dozen young trees in one day. Several of the young plantations in Ross-shire are swarming with these creatures, and in their own interests we would advise the landed proprietors to combine together and exterminate them. Singly, very little could be done, but were the owners of all the plantations in the county to unite in their destruction, their little foes would speedily disappear."

With this suggestion we do not agree. Squirrels are like many other wild animals, destructive to an injurious extent when their numbers are excessive, but to "exterminate" them is not necessary to the safety of our plantations. Keep their numbers within due bounds by all means, as when numerous they can do a lot of mischief, but we trust that systematic

extermination will never be attempted, and we may safely prophesy that if tried it will prove a failure.

Next follows a most instructive paper "On the *Taxodium Sempervirens* for Timber Purposes," by Robert Hutchison, of Carlowrie, Kirkliston, who holds a high opinion of this tree, the Californian redwood, as being likely to speedily produce a large quantity of excellent timber when properly cultivated in suitable localities in this country. He observes, "It may be suggested that for the successful rearing of *Saxodium Tempervirens*, and such other descriptions of the coniferous family as are liable to be injured by late spring frosts in this country, and especially for such as are prone to throw out their wood growths early in the season, *home nursery seedlings*, reared in the soil, and about the altitude of the climate in which they are ultimately to grow, are far more certain of success, and appear to be hardier in constitution for the site, than transplanted seedlings bought and sent from a distance, and probably from a very different position. It is to treatment of this description that the marvellous achievements of the late Mr. Humphrey Graham, of Belstane, in successfully rearing to timber size almost every species of the newer Coniferæ in the poor bleak soil of the top of the Pentland Hills, in Mid Lothian, are to be attributed; and were more care shown to this branch of arboriculture, namely, to the growing of plants from good seed in a small nursery on the estate which they are intended to adorn, there would be fewer records of failure in early years of several of the varieties."

It is the same law, which is so well known in the agricultural world, that operates in the arboricultural field in this particular branch of nature's economy. In high districts where the climate is cold and the summers are short we find the crops shorter and later, and field operations of all kinds carried on long after similar work is completed in the lower and earlier districts; and so it is with the seedling trees of such sites. The operations of growth are retarded, and nature is, as it were, by slow degrees in the earlier years of the plant, made to alter her period of shooting into annual activity to a latter date, so as to accommodate the life and functions of the seedling to the new condition in its adopted sphere; and as "*habit becomes a second nature*," the seedling conifer sprouted and grown from its infancy under circumstances of climate somewhat uncongenial to its nature in its own habitats, becomes an altered variety in constitution, and acquires the ability to withstand the vicissitudes of temperature and exposure, which it would not acquire in its own country, or even in lower and more sheltered positions in Britain. Statistics are given of over sixty of the largest specimens of taxodium in Britain; the highest in England, at Strathfieldsaye, Hants, being 64 feet by 6 feet 2 inches in circumference of stem at 3 feet from the ground, followed closely by another very handsome tree at Longleat, Wilts, which is 63 feet high and 8 feet in circumference of stem at 3 feet from the ground. The highest in Scotland is at Rossie Priory, Perthshire, "a most beautiful plant feathered to the ground," 50 feet 3 inches high, by 7 feet 10 inches in circumference of stem, at 3 feet up. Many others in both countries

closely approach these measurements, and having been all planted since 1845 they clearly prove its rapidity of growth in the British Isles. No statistics are given of the growth of taxodium in Ireland, but our impression is, that it is a faster grower there than in either England or Scotland, and that larger trees of it than the above are to be found in that country, where some of the newer coniferæ make extraordinary growth, and are seldom or never injured by the severity of the climate.

An essay, entitled *Manual of Agriculture, including the Application thereto of Chemistry, Geology, Botany, Animal Physiology, and Meteorology,* by Richard Henderson, Coldstream, is a well-digested epitome of the sciences of chemistry, geology, botany, animal physiology, and meteorology, as applied to the art of agriculture; in the tillage and fertilizing of the land; drainage; crops, and their proper rotation; stock-breeding and feeding, &c.; all matters of the very greatest importance to farmers in the present state of farming, which cannot be carried out with the best effect and greatest profit without a thorough knowledge of the scientific principles upon which every operation in the art of agriculture is founded.

On the Tree Mallow, Lavatera Arborea, as an Agricultural Plant for Cattle-feeding, Papermaking, and other purposes, by William Gowrie, Rait Lodge, Trinity, Edinburgh, is an interesting account of the energy and perseverance displayed by Mr. Gowrie in introducing this native plant to the notice of the public, and those who are likely to be largely benefited by its extensive cultivation as a valuable food and fibre producing plant. Mr. Gowrie has tried so many and varied experiments with the plant, that there can be no doubt of its thorough adaptability to cultivation, and its exceeding luxuriance and productiveness in exposed parts of our coasts, where no other cultivated plant of its altitude is able to rear its head against the blast, thereby affording a highly remunerative return from land, which has hitherto been totally unproductive. He also recommends it as quickly producing excellent shelter for young plantations exposed to the sea-breeze, "it being peculiarly adapted for affording protection to the young trees before these attain sufficient size to shelter one another. When thus employed it is advisable to sow the mallow seeds in nursery drills, or beds, towards the end of June, so that they may not flower next year, and transplant them as soon as they are 4 to 6 inches high, where the forest trees are to be planted next spring. For succession, another planting of like-sized mallows should be made in July or August following, to remain green, and so maintain the shelter after those first planted have seeded and been harvested. Afterwards the seeds that will get scattered annually, even with careful harvesting, will suffice to keep up a sufficient succession as long as the sheltering aid of the mallows may be needed." Seeds of the plant have been distributed this spring throughout the length and breadth of Great Britain, from Shetland in the north to Devonshire in the south, as well as to various places in India, South Africa, Australia, New Zealand, Canada, and Nova Scotia; so that it is satisfactory to know that we will soon be able to learn to what extent

it can be profitably cultivated in Britain and various other parts of the civilized world.

Another report, by Thomas Farrall, *On the Polled Angus, or Aberdeen Breed of Cattle*, being purely an agricultural or stockbreeder's question, scarcely comes within the scope of our remarks ; but, being a well got up report by an enthusiastic admirer of that valuable meat-producing breed of cattle, those who are interested in the subject will be well rewarded for the trouble they may take in reading it.

The Transactions concludes with short reports on several very interesting and instructive trials of implements and machinery, selected by the Society for testing during 1876, including Fisken's steam cultivating machinery, which passed favourably its investigation and trials ; Robey and Co.'s threshing machine, which also gave good satisfaction ; Koldmoo's weed eradicator, which appears to be a very clever invention for extracting weeds in corn-fields, &c., without injury to the growing corn ; Barclay's cultivator, a useful implement of comparatively light draught ; and potato planters—six of these ingenious contrivances for saving labour were put on trial, but none of them proved perfect at the work, although the Society awarded a £10 prize to the best machine on the "Cup" principle, and a similar prize to the best on the "Needle" principle, to mark the great improvement made in such implements. A water-testing apparatus, by Davis and Co., London, was not considered of any merit; Murray's threshing machine performed its work in a very satisfactory manner ; and at the trial of "turnip raisers" four machines turned out for competition and investigation, the best of was that invented or owned by James Thom, Ledeu Urquhart, Strathmiglo, Fifeshire, which performed its work in a manner far superior to any of the others. It pulls the turnips, tops and tails them, and throws them to one side the same as a potato-digger.

Appendix A contains details of the Society's proceedings at board meetings and at general meetings ; the premiums awarded by the Society in 1876-1877 ; and a statement of its financial affairs, which shows the Society to be in a very flourishing condition, with nearly £63,000 to its credit. Appendix B contains a list of the premiums offered in 1877 ; a general notice of the institution and career of the Society ; its constitution and management ; establishment, and committees for 1877 ; examiuations in agricultural education, and also in veterinary knowledge ; forestry and chemical education, for excellence in which the Society grants certificates or diplomas ; reports on the science and practice of agriculture ; estate improvements ; machinery, and forestry. Appendix C contains a list of the members of the Society, and closes a volume of scientific and practical knowledge of much interest to all concerned in the management and improvement of the rural affairs of the country.

The Indian Forester. Edited by W. Schlich, Ph.D., Conservator of Forests, Bengal. Central Press Co., Calcutta.

The January number, No. 3., Vol. II., of this quarterly magazine, contains a variety of articles of much interest to the forest officials of our

Indian empire; and gives the British public some insight into the laws and regulations which govern that branch of State economy, as well as an idea of the vast extent of the Indian forests, and the important influences they have on the soil and climate and the social and sanitary welfare of the country.

The number opens with a long and rambling "Note" of 26 pages "On the Demarcation of the Forest Area in Districts containing Hill or Mountain Ranges," giving some good advice on laying out the boundaries of forest land, and "taking stock" of the trees growing upon it, which will be found a useful method where extensive forests have to be dealt with. "Supply and Demand in their relation to Working Plans" and "Subordinate Forest Establishment" are of the grumbling order, and of no interest but to the limited few concerned. In a "Memorandum on Jungle Fires," by M. J. Slym, D.C.F., British Burma, are some good suggestions upon the benefit of judicious burning of teak forests, and the injury done by indiscriminate burning. He remarks:—

"There is a general belief among the majority of forest officers that these fires yearly do a great deal of harm to the teak-producing parts of the forests, and, considering what a number of seedlings must be either killed or injured by them annually, the current view would at first sight not appear to be entirely without grounds.

"A great deal has been written both for and against these fires; many have pronounced their effects upon the forests to be unqualifiedly injurious; some even think that they must be prevented at any cost; while others believe that they act favourably towards the growth of the teak, and the Commissioners in Bengal are of opinion that these fires kill yearly a great number of injurious insects and their ovaries which adhere usually to fallen leaves, &c.;" and after discussing and examining the matter in a sensible manuer, he concludes by saying, "The collective inference I draw is that these fires should not be prevented *entirely*, but the strength of them sufficiently lessened to lessen the harm. This can only be effected by firing the forest ourselves two or three times during the dry weather, commencing in the beginning of February, before the leaves are so thick on the ground as in burning to cause an injurious heat to the trees; while in each interval the quantity collected would be insufficient to cause any harm. Those engaged in firing the forest could clear the young and old trees from creepers or any vegetation endangering their growth. I would also recommend the burning of all dead bamboo tracts, and afterwards casting over the surface a large quantity of teak seed; the bamboo may spring up again, but the kind we find on the hills usually grows in clusters, with sufficient room between them to allow the growth of teak saplings. If these belts of dead bamboo with which our forests are periodically intersected are left unburnt, millions of the seed germinate which otherwise would have been destroyed, and the country becomes such a wilderness, there is no chance left whatsoever for the springing up of a teak seedling amongst the bamboo; besides, the ground being covered by rubbish and the teak seed being large, the latter remains on the top of it to rot, and the smaller kinds of seed, which penetrate this rubbish and come in contact with the ground, have a better chance to germinate.

"The Political Value of Forest Conservancy" is argued at considerable length by B. H. B. P, but is much more suitable for a newspaper article

than the pages of a professional magazine. Passing over eighteen pages of "Reviews," which are discussed from an Indian point of view with considerable ability, but contain nothing of general interest; and also omitting several articles of local or minor importance, we give a full extract of an interesting paper by G. H. Foster, Assistant Forest Conservator, Central Provinces, on the failure of Eucalypti at Saugor and Garhakota:—

"Perhaps the accompanying few notes concerning the experiments with Eucalypti, carried on in this division, will be found interesting. In August, 1875, Mr. Richardson planted a few seeds in an earthen gumla, they were *E. globulus,* and another kind marked by him "iron bark." This, from its after-growth, seems to have been the same as that marked *E. viminalis,* sent from the conservator's office. The plants germinated in September, and in the end of December, 1875, I put them out into baskets according to the conservator's directions. The baskets avoided the necessity of moving the trees a second time, for, being of a perishable nature, they could, when the trees were planted out for good, be put into the ground as they stood, and would during the first rains rot. These trees were all in Saugor. In December, 1875, I sowed a great number of seed at Garhakota, of the following eight species:—

E. globulus.	*E. cornuta.*
E. marginata.	*E. sideroxylon.*
E. viminalis.	*E. rostrata.*
E. fissilis.	*E. obliqua.*

"These germinated at various times up to the end of January very freely, and when in the end of February I commenced transplanting them into separate baskets, I had nearly 2,000.

"I will keep the two sowings apart—1st, the Saugor sowing of August, 1875. As before mentioned, I potted these out in baskets in the end of December, 1875. I had then twenty-three *E. globulus* and five or six *E. viminalis.* I was unable to see much of these, as I was always in camp, but they were carefully tended and watered, and when the hot winds commenced they were put under shelter. The majority grew very well, one *E. globulus* growing up to four feet in height by May; but in the end of May they suddenly died. I was out of the station, but my subordinate there reported that they appeared sickly, the top shoot drooped, and then in two or three days they dried up. Two alone escaped. These I planted out in my garden in July. One, *E. globulus,* died; and the other, *E. viminalis,* is dragging out a miserable existence at present. The soil they were sown and potted out in was a poor 'kábar' or wheat soil. The sowings in Garhakota were all in kábar soil, but the pottings out were, in a few cases, in alluvial and in sandy soil. I observed no difference in the result. Of the different species the *E. globulus, E. cornuta,* and *E. fissilis* germinated most freely, the second on this list being wonderfully fertile. They no sooner were put out into baskets than they began to die, but this was probably from their being too young. The way I got them out of their nursery baskets was by putting the baskets into water, and thus washing the earth out. By the beginning of May I had about 1,500, of which 1,132 died in a fortnight. The weather during these days was terribly hot and unusually oppressive. The deaths occurred principally among the kinds other than *E. globulus.* This tree and *E. cornuta* and *E. rostrata* seemed most able to stand the heat. All this time the trees were under a thatched cover, and were

watered twice a day. From this time the deaths decreased wonderfully, but still a certain number died up to the day I transplanted them. This was done purposely in different soils and situations. Some were planted close along the bank of a perennial nullah; some in a marshy spot where the water generally collects in the rains; others were planted on a height, a well-drained knoll. The results are difficult to appreciate. Death has been impartial, and selected his victims from those on the knoll equally with those in the marsh, and of the seedlings only 111 remained alive when counted a few days ago. These are distributed in all soils and situations, and consist of an equal proportion of all, save *E. marginata*, of which only six or seven germinated in the first instance.

"The wonderful development of growth is not discernible in these Eucalypti, for my tallest tree is not five feet high.

"Some seeds received from the conservator in June were sown by me in the rains (August). These were—

E. globulus.	*E. amygadalina.*
E. cornuta.	*E. viminalis.*
E. fissilis.	

"In Saugor I selected two kinds of earth, one the afore-mentioned 'kábar,' and the other decomposed sandstone taken from the lower slopes of the hills round the station. The plants germinated fairly freely in the kábar, but very poorly in the red earth. They were healthy when I last saw them last month. Of the same seed I sent down a parcel to Garhakota to be sown. They were sown in three kinds of earth, one 'kábar,' the second hill detritus with lime mixed in it, and the third river alluvium. These have been an utter failure.

"There was one *E. globulus* in the police gardens in Saugor, the only one left of many trees. This grew to a height of twenty feet between December, 1874, and June, 1876, and then without rhyme or reason died. The Cantonment magistrate of Saugor has some still alive, and Major Loch, the Deputy Commissioner, has been, I believe, successful up to the present. Various other experiments were tried in the station. One gentleman, who had been in Australia, tried to grow two kinds, *globulus* and another, without water and on hilly slopes, with very little soil. They thrived (six of them) till the rains, when they died off at once. Colonel Kincaid, Political Agent, Sehore, was successful, I believe.

"With regard to the few young trees I have now in Saugor, I have quite given up hopes of their ever growing to any height, and I think, with reference to Saugor at any rate, that the Eucalypti are a failure. Had even a greater per-centage of the trees in Garhakota survived, I do not think Government would be justified in carrying on the experiment, for the expenditure would be by far too heavy, as the growth here is nothing like as rapid as it is in the Nilgiris."

The remainder of the magazine is full of interesting short "Notes;" but the limits of our space prevent us from giving further extracts, with the exception of an interesting article entitled "Rats in Nurseries," which we have reprinted in full on another page, and which we think will be read with much interest by all who have the care of a nursery or young plantation, and are plagued with vermin, destroying their seeds and stock. Sixteen pages of "Extracts from Official Gazettes," &c., contain a long list of appointments, exchanges, transfers, &c., in the Indian Forest Department, which will be read with interest by officials and their friends.

The magazine generally reflects creditably upon the interest which the Indian Government takes in the conservancy and proper management of its extensive forest lands, and fully merits a wide and liberal support in furtherance of its laudable aims.

Estate and Farm Book-keeping. By ALEXANDER JEMMETT, M.I.S., Murrell Hill Farm, Binfield, Berks.

The author of this clear and concise system of Estate and Farm Book-keeping is a gentleman of long and varied experience in estate management and practical farming, both at home and in our West Indian possessions, and is thoroughly conversant with all matters of detail in the systematic recording of the income and expenditure upon landed property, whether it consists of an estate of many thousands of acres, or only a farm of a few fields of small area; either of which can never be managed on a proper and satisfactory basis without the aid of clearly detailed and accurately kept records and account-books, of which Mr. Jemmett's are the best examples that have yet come under our notice. By the introduction of them the author has conferred a great boon on all who have the active management of estates and farms, who desire and may be required to be ready at all times to give a correct account of their stewardship.

The Estate Account Book is specially intended for use on large estates, ranging from five or six thousand acres upwards, where there is a resident factor or agent for letting farms, receiving rents, superintending improvements, &c., with a home farm of large extent, policies, woods, and plantations in hand; besides let farms, cottages, quarries, brickyards, corn-mills, &c.; the operations, transactions, and financial details of the whole being clearly recorded in *one* book of easy reference, which may be kept in a perfectly correct manner, with the least amount of trouble, by any one who has the slightest knowledge of commercial book-keeping. The want of such a clear and accurate record of every transaction, financial and otherwise, on an estate, of however limited extent, often gives rise to a vast amount of trouble and anxiety, ending at times in difficulties that are both vexatious and ruinous, and which in all probability could have been easily foreseen and prevented had a simple and correct system of book-keeping been in use, carefully kept, and regularly examined with a view to ascertain to a certainty where the profit was and where the loss.

The Farm Account Book is on precisely the same principles, and suitable for the correct recording of all matters—finance, stock, crops, labour, &c.—connected with farming on a large or small scale; and we would strongly recommend young farmers who are beginning business to get Mr. Jemmett's account-book, and carefully jot down all their transactions and operations, daily and regularly as therein provided for, thus creating and fostering a correct and systematic habit of conducting their business, and enabling them at any time to see at a glance whether or not their farm is producing year by year a profitable return upon the capital they have invested in it.

Of course the precise system adopted by Mr. Jemmett in these books is not expected to suit all cases, but there are few estates or farms on which some slight modification of them will not be found perfectly suitable and of the greatest service to proprietors, agents, and farmers, enabling them, with the least amount of trouble, to see how their balance-sheet stands for each year, and, if necessary, to trace with ease and accuracy every item of income and expenditure.

Among the numerous newspapers and magazines representing almost every department of agriculture and rural economy that we have received from various parts of the world, we may mention—the *Lancaster (U.S.) Farmer*, an excellent farmer's paper; the *Albany (U.S.) Cultivator and Country Gentleman*, covering somewhat the same ground as our *Field*, and full of useful intelligence; *Der Gartenfreund* is the name of an Austrian botanical and horticultural magazine, published at Vienna, and which appears to be ably conducted; *La Revue des Eaux et Forêts* is probably known already to some of our readers as having for many years been the faithful representative of forestal affairs in France: the present number contains interesting articles on the administration of forests in Austria, and on cubic measurement, and the usual complement of forest news; *Revista de Montes* is the organ of the Spanish forest service, published at Madrid, and contains much useful information. We thank the editors of these and many other periodicals for their kindly notices of our first number, and in exchange for our own shall hope to get their papers regularly, so that we may give translations to our readers of any articles which would be interesting and instructive to them.

Plant Pathology.

The following interesting article on this subject by Edward John Tilt, M.D., appeared in a recent number of *Hardwicke's Science Gossip.*—It is difficult to get out of a groove, and the habit of looking at mankind as either healthy or diseased sticks fast to me when riding about the Windsor woods and forests, and I am always on the look-out for patients among the trees. Trees resemble human creatures: the strongest bear traces of repaired mischief; many give evidence to good conservative surgery, in the shape of well-formed stumps and the healing over of extensive wounds; but many trees get wounds that cannot be healed by nature, and constitutional diseases that are fatal. Riding the woods reminded me of my first impressions when walking the hospitals as a raw medical student. It then seemed to me that I could understand surgical cases, but it was like looking into a bottle of ink to attempt to understand fevers and constitutional diseases. In the woods I am quite at home with forest surgery, and quite at sea with the constitutional diseases of trees.

I have asked,—what is dry-rot, wet-rot, and touchwood, and what relation they bear to each other, of some who are learned in trees, without getting very satisfactory answers, and my ignorance is still unenlightened. To make clear its extent, I will note a few facts, and the inferences suggested to me by my acquaintance with human pathology.

Touchwood.—To grow fine timber, young oaks are left to grow sufficiently near each other to check the free access of air to their lower branches. Their scanty foliage and diminished supply of sap stop their growth, they become brittle, lose their moisture, and turn to touchwood. Windsor Forest is thus strewn with the lower branches of oaks planted in 1820. I have picked out great lumps of touchwood from the trunk of a large and still vigorous columnar beech, the longitudinal half of which had been broken away some years ago. The wood near the bark was quite sound, but the central part of the wood, deprived of sap and exposed to the air, had become touchwood. *Has a fungus anything to do with this process of disintegration, or how is it effected?*

Wet-rot.—During the great wet of last September, and in a very wet hollow of the forest, I one day found that a well-grown oak, about 400 years old, had snapped across at about three feet from the ground; and the freshness of the foliage, as well as the cleanness of the wound, showed the smash to be very recent. It was a fine case, with bold splinters of sound wood, for the tree was for the most part healthy; but it was easy to see that as the sound wood approached the point of fracture it was simply wet, then it became soaked with wet. Nearer to the seat of mischief this soddened wood could be easily broken up with the fingers, and showed that a fungus was at work between its rings. In a hollow, where the tree had snapped, could be seen how actively this fungus was doing its work;

for I could tear out large masses of a yellowish-white-looking, sweet-smelling, spongy, elastic substance, reeking with wet, in which the concentric rings could still be traced, separated by a white soft pith-like fungoid growth. This tree had some years before been seriously damaged near the point of fracture, for there was a dark-coloured flesh-wound, and a hole in this wood was lined by dry-rot, to a very limited extent. I believe that in this case the dry-rot only acted as a wood-perforator to flood with water the central parts of the tree, and I never met with another case in which dry-rot was associated with wet-rot. Mr. Menzies, the highly-accomplished Deputy Surveyor of Her Majesty's Woods and Forests, looks upon wet-rot as a purely local disease, to be cured by scooping out of the tree all its diseased wood, and by preventing the access of water. I showed a bit of the spongy substance just described to a country gentleman, and he told me it would turn to touchwood when dry, but it is now tough and semi-elastic. *What is the ultimate stage of the pathological process I have described? What is the name of this fungus of wet-rot?*

Dry-rot.—In badly-built houses wood gets the dry-rot, or, in other words, damp develops a fungus in dead wood, which soon crumbles it down to the well-known russet powder. As this dry-rot of timber cannot be called a disease, so in living trees the brown wood crumbling into a russet powder is not a disease, but the last stage of a prolonged process of decay. Long before a tree shows the characteristic signs of dry-rot, the wood has been deeply and extensively discoloured; it also loses its tenacity, and thus shows how deeply its mode of nutrition has been perverted. One of the elms in the Long Walk, two hundred years old, was lately cut down, and the whole trunk was of a deep brown colour, with the exception of a few external rings of sound white wood. I should suggest that the discoloration of the wood is no more the disease than the crumbling wood and dust, and that the disease is some impairment of the living force by which the tree started into life, and has been able to grow. The disease calls to its aid a fungoid growth, to damage the texture of the wood and to reduce it to powder. The real cause of the disease is, therefore, some constitutional taint, rendering it as incurable as cancer. In examining that portion of the elm that was broken across, after having been nearly sawn asunder, it was beautiful to see the concentric deep brown rings, separated by the broken ends of a white feathery fluff. If that was a fungus, then it was already set in the changes that accompany the discoloration of the wood. Later on, the reduction of the wood to a red dust is brought about by the fungus of dry-rot; but even if a fungoid growth were progressing from the top to the bottom of the tree, as in the elm, I should no more call that internal fungus the disease than I would say a tree was dying of the various fungi that disfigure its beauty and foretell its death. *Is the fungus of dry-rot the same in all trees? Is it the same as the fungus of wet-rot? Is the fungus of dry-rot in a living oak the same as that of an oaken beam?*

Except in the instance related, I have never met with dry-rot and wet-rot in the same tree; neither have I met with dry-rot and touchwood side by side in the same tree; but nothing is so common as to find oaks attacked by dry-rot in their trunk or in some large branch, while their small branches are being turned to touchwood, and strew the ground.

Correspondence is invited on this subject—[*Ed. J. F.*]

Plant-Growth.

Mr. W. T. Thiselton-Dyer, M.A., Assistant Director, Royal Gardens, Kew, lectured on March 26th, at the London Institution, on "Plant-Growth and its Present Problems." He said Linnæus, in a celebrated definition, had attributed growth to each of the three kingdoms of nature. Mr. Dyer then pointed out the distinction between the mere acception exhibited by a crystal and the "intussusception" of new material which was characteristic of plants and animals. This was the result of what was known as their cellular structure, the history of our present knowledge of which was then traced. It was due, in the first place, to two former secretaries of the Royal Society—Robert Hooke and Nehemiah Grew,—who in the latter part of the seventeenth century clearly made out the fact that plants were made up of the units of structure, which they called bladders or utricles, and which are now called cells. Hooke's observations were made on a familiar substance, cork, the true structure of which he accurately described; but Grew's investigations, spread over a much wider field, were, with the appliances at his command, practically exhaustive, and were wonderfully accurate even in the light of present knowledge. They were also thoroughly confirmed by the contemporary researches of Malpighi made at Bologna, the publication of whose observations was only preceded by a few months by that of Grew. During the eighteenth century investigation in this subject proceeded along lines altogether erroneous. The want of a correct understanding of animal structures, and the desire, in itself laudable, to recognise a unity of plan of organization in the two kingdoms, led to the view that plants were made up of fibres and thin plates. Wolff (who anticipated the poet Goethe in his discovery of the true relation of the parts of flowers) was no less at fault in imagining that plants were composed of a uniform material excavated into minute cavities and canals: some survival of this view exists even to the present day. With the commencement of the present century a fresh start on the true track was made, and once more in England. The accurate description by the celebrated botanist, Robert Brown, of the minute body contained in cells, and known as the nucleus, and as to the function of which at the present moment the most important researches are in progress, attracted attention to the cell as the true unit of structure. The cell theory, as it was called, received in the course of a few years a complete development in the hands of Schwann and

Schleiden. Von Mohl gave it its present complete form by discovering the manner in which cells were multiplied by repeated division, thus laying bare the mode by which growth was actually effected. He also first detected the importance of the peculiar living matter which is contained in cells, and which is their really essential part. To this he gave the name of protoplasm. The lecturer then proceeded to show that in the green parts of plants minute portions of this protoplasm are separated from the rest and assume a green colour. In these chlorophyll corpuscles, as they are called, starch is manufactured during the day from the carbonic acid drawn from the air, and the water which ascends from the plant roots. During the night the starch is dissolved and "wanders" over the plant, to be accumulated in stores or employed for growth. The influence in these and other processes of the different constituents of sunlight was then considered. It was shown that the red rays had to do with chemical, the blue rays with mechanical activity. The blue rays in sunlight actually had a retarding effect on growth. Consequently, putting the effects of the difference in temperature aside, it could be demonstrated that plants grew faster by night than by day. During the former they used the building material they manufactured during the latter. Plants grown in the dark were said to be "drawn;" but, in point of fact, they were only taller because they were removed from the repressive action of light. So to the movement of plants towards light was probably due the curvature of the stems, in consequence of the illuminated side growing more slowly than that which was shaded. The repressive action of light was confined to its blue portion, which proved the absurdity of the recent statements in American papers about the influence of blue light in stimulating growth. Although sunlight was necessary to the activity of chlorophyll, in excessive amount it destroyed it. An instance of this was afforded by the change of colour in ripening fruit. Plants appear to have various contrivances for shielding their chlorophyll from this injury. The thick epidermis of leaves and their hairy investments were some of these. Young leaves were also, at first, often turned edgeways to protect the nascent chlorophyll grains from undue exposure. Finally, the protoplasm, which possessed powers of movement of its own, actually even dragged the chlorophyll grains from the illuminated sides of the cells, allowing them to return again during darkness.

Prices realized for Timber in Morayshire.

By D. SCOTT, WOOD MANAGER, DARNAWAY CASTLE, MORAYSHIRE.

The prices realized for timber in this county will bear favourable comparison with most other counties in the north of Scotland. There is a considerable extent under timber, especially in the western part of the county, where are situated the forests of Altyre and Darnaway. In the Forest of Darnaway there is an annual sale of hardwood, composed

chiefly of oak. This sale has been in existence for upwards of fifty years, and is numerously attended by those engaged in the ship and boat building trade, also by timber merchants, cartwrights, &c. It is well known that oak does not now command the same price as it did twenty years ago. About that time the price of good oak in this forest, for ship and boat building purposes, was from 3s. 6d. to 4s. 6d. per cubic foot. This cannot now berealized, as other material is extensively used for those purposes, and there is also a foreign timber supply to contend with. It may be here stated that the prices given for boat timber depend not a little upon the success of the herring fishings on the north and east coasts.

The following quotations were given at last annual sale :—

Oak.—Heavy "crooks," for ship and boat timbers, from 2s. 6d. to 3s. 0½d. per cubic foot; smaller crooks, from 2s. to 2s. 3d. ; heavy straight trees, from 2s. to 2s. 6d. per foot. Smaller sizes from 1s. 6d. to 1s. 10d. ; inferior lots from 1s. to 1s. 3d. "Burnwood" (firewood), which is readily bought up for fish-curing purposes, 15s. per ton ; small oak branches for firewood, 6s. per ton. Bark, £7 sterling per ton, delivered at nearest railway station two miles distant from store sheds.

Ash, first quality, 3s. to 3s. 7d. per foot, second quality, 2s. 6d. Elm, first quality, 2s. 6½d. per foot; second quality, 2s. to 2s. 3d. Inferior lots of ash and elm, 1s. 6d. to 1s. 9d.

Beech, straight, and of a size for boat keels, 1s. 11d. and 2s. per foot. "Burnwood," consisting of ash, elm, and beech, 10s. per ton. Birch, for bobbins, burnwood, &c., 12s. per ton. Alder, 10s. per ton.

Larch and Scots firs, when sold in large lots, command a very remunerative price if grown on suitable soils. This class of timber is sometimes sold by "public roup" and sometimes by "private tender." Mixed thinnings are generally sold by public roup, and are bought by farmers and others at what they are worth.

Lots altogether of pitwood are, as a rule, sold by "private tender," either by the dozen of 72 linear feet, or a lump sum for a certain number of trees ; generally the latter mode is adopted. "Crown props," five inches diameter at small end, gave 4s. per dozen here last January, and "common props," three inches diameter at small end, 2s. 6d. per dozen. The price of pitwood greatly depends upon the supply and demand. It has had a downward tendency since the above quotations were given, and is at present in less demand.

The following may be quoted as the average prices given in this locality for the various sizes of fir timber:—Larch, suitable for boat-sheathing, 1s. 3d. per cubic foot; smaller sizes, 1s.; larch fencing posts, 6 ft. long, 4 in. diameter at small end, sawn out of full-grown trees, 8d. each ; larch thinnings, posts, 6 ft. long, 4 in. diameter, 6d. each ; smaller sizes, 4d. each ; sheep net stakes, 5½ ft. long and pointed, 2d. each. Scots fir in large lots, "sleeper size," from 8d. to 10d. per cubic foot; smaller sizes, 6d. to 7d. per do.

Instances could be given of a timber crop, consisting of larch and Scots

firs, realizing an annual rental of from 30s. to 50s. per acre on land which, under any other crop, would not bring half that rental.

Throughout the county prices vary considerably, as much depends upon the convenience of the timber to the market, and the distance to the nearest railway station.

Underwood and Timber Plantations.

In this age of wealth, the owners of which justly claim to enjoy the luxuries and pleasures of healthy life, while others who are in their confidence are using their capital, by the exercise of ingenuity, energy, and perseverance, in well-directed systems for the development of all the crafts that employ our multitude of labourers (in earning the means to satisfy their various necessities and desires, by guiding and aiding the labour-saving inventions (of heaven-inspired men), to harmoniously work out the production of all that man in his varied constitutional appetite desires.

It is therefore, to help to meet this great want, expedient that all underwood and timber plantations should be used as nurseries for winged game properly reared and fed, while all rats, rabbits, and other vermin, that destroy trees and crops, should be, as far as possible, annihilated, as creatures that are inimical to the profitable growth of underwood.

With a view to the attainment of this object in its better form, all plantations should be laid out into triangularly shaped sections, from 80 to 100 yards wide at one end, and from 40 to 50 at the other, by drives or gangways from 3 to 4 yards wide.

The beaters or drivers enter the wide end of the section like a wedge, the middle man, with a tenor handbell, first; the others follow at proper distances, each a little behind the other, last near outside, each one with a treble bell. The sounds of these bells will guide, and enable the beaters to keep their places, also the sportsmen to keep in the best situation on the side drives. The beaters in this form will force the game to take wing and fly towards the sides where the sportsmen are, and as the beaters progress toward the narrow end, they get closer together ; thus as more game get on the move, the beaters are in closer position to prevent any escaping back, while the sport gets more regularly and fairly divided.

The length of the sections should not exceed 300 yards, because irregular sport arises through the contraction not increasing fast enough to force the game out until considerable advance is made up the section, towards the narrow end. Where plantations are large, a drive all round, about 40 yards from the outside, should first be made, then drives from 200 to 300 yards apart, running from east to west ; these will form the ends of the sections, and rule their length, also insure the side drives running in a north and south direction, which will give all the birds while rearing a fair share of mid-day sun.

Early in June all the drives should be mown, and the underwood cut or brushed up on each side of the drives. The cut twigs with the grass

will make useful rough hay, leaving the drives in nice order to receive the hens, with their broods of birds, to be grown up naturalized to the wood. Before planting underwood it is judicious to find what purpose it can be sold for, and what are the sorts of poles that are most esteemed in the market; then ascertain what sorts grow the most luxuriantly on the soil, and select the best growers for the purpose required.

I know several cases where chestnut and ash were at great expense planted where the soil would only grow inferior stuff (such as birch) well, and pay for a horse before the former would buy the saddle.

Much may be done on wet soils by judicious open draining and trenching the land before planting, with good cultivation afterwards, towards success in growing the highest class of plants suited to the soil, such as ash, larch, and willow; but on such soils brown birch will often pay much better for poles, and oak for timber.

The drains should be 11 yards apart, and for hop-pole growing, nine rows of plants 42 inches apart (except the rows the drains are in, which should be 5 feet), the drains 2 feet deep, 2 feet wide at top, and 8 inches at bottom, deepened to 30 inches after the first fall of poles; the plants are to be 4 feet apart in the rows, and put in opposite the space of those in the preceding row. When carefully planted they will be 4 feet from plant to plant, and rows 42 inches apart in three directions. This will require 2,970 plants. A larch planted in every second space in the rows, and in every second row, will take 762 plants. If intended ultimately for timber, one-fourth of these should be substituted by oak or other hard wood or pines, making 3,732 plants per acre.

Late in March 4 cwt. of superphosphate at 7s. 6d., 5 cwt. of kainit at 4s., and 2 cwt. of nitrate of soda, 15s., applied per acre, and shallowly dug in with a row of good potatoes planted betwixt the rows, the seed costing 60s.; two deep diggings during the summer, with moulding up the potatoes, at 25s. each; which, with digging 6 tons of potatoes and storing them, at 40s. per acre, will be a total expense of £13; the return, 6 tons of potatoes at £3 = £18, leaving £5 towards expenses of planting. The same should be done the second year betwixt the row in another direction, leaving another £5 towards planting expenses, and the trees benefited by the residue left from the two manurings, and the land twice well fallowed.

The third year three good hoeings, at 5s. each, and one the spring of the fourth year, should leave the trees strong enough to keep weeds down by overshading; at the end of the tenth or twelfth year these should realize from £20 to £30, leaving all the larch and hardwood trees standing; all perished plants should then be replaced, and the drains deepened.

The next fall will be ready in eleven years, when half the larch and underwood should realize from £40 to £60 per acre.

Where the soil is light, and especially of a sandy nature, Spanish chestnut is both the fastest grower and the most valued in the market, but they will not bear overshading, therefore but few trees should be grown

for ornament, and only but a few roosting trees, if profit is the sole object. On such soils draining is seldom required, but should be strictly attended to where it is necessary.

The land should be trenched, and the rows 42 inches wide, and 48 from plant to plant, taking 3,180 plants; if timber is determined upon, then every eighth plant in every ninth row, 43 plants, should be substituted by whatever timber trees are desired. Chestnut grows rather slowly at first, therefore three crops of carrots can be got; two drills a foot apart betwixt the rows of trees, taken in a different direction each year. The cultivation and manuring will be the same as for potatoes, the seed much less expensive, also the labour; therefore £11 per acre amply covers it.

From 15 to 20 tons per acre ought to be grown, worth as horse or cow food 25s.; and for culinary use double that price per ton, leaving at least £8 profit, and the land well fallowed each of the three years, thus leaving the land all that can be desired as to manure and cultivation for the development of the plantation.

On marsh land, willows and alder as underwood, with ash, black poplar, &c., as timber trees; on poor, cold soils, black birch for underwood, with oak, Scotch and Corsican pines for timber, will succeed satisfactorily.

When underwood is required for fencing, hurdle-making, &c., a greater distance has to be allowed betwixt the plants, because a growth of from 16 to 18 years is required; therefore the rows should be 62 inches apart, and the plants 72 inches, taking 1,540 plants; also a larch planted in every second space of every second row, taking 385 plants. Other timber trees for the ultimate plantation must be substituted, instead of every third larch plant, in every third row of larch, making 43 plants of timber trees of the kinds desired. Underwood of this description should realize, at eighteen years' growth, from £20 to £40, leaving all the larch and timber trees; the next fall, cutting down half of the larch, the rest being gradually thinned out, leaving the underwood timber trees in possession.

I thought these few details might help to induce owners of plantations, and those about to plant, to turn them to the best purpose by adopting the most profitable arrangement, and when planting to see that it is well done, which must pay best.

There are large areas of cold clays and light sandy soils that would pay much better where there is a market for underwood, managed as before stated, than they do for agricultural use. I know plantations of chestnut, on sandy soil of moderate fertility, that give an average return of £40 every tenth year, and are now realizing 10s. per acre per annum as pheasant shootings. Chestnut, larch, willow, and ash 14-feet hop-poles are now making from 24s. to 30s. per 100, and 16-feets from 34s. to 40s. Birch, alder, maple, and sycamore, 15 to 20 per cent. less, and hornbeam, oak, &c., about 30 per cent. less.

In Kent, well-managed plantations frequently realize by auction from £50 to £60 per acre as they stand, on poor sandy soil. The expenses are, cleaning out the drains, mending roads, and filling up after each cutting where plants have failed.

The watchword to unfailing success in underwood growth is, death to rabbits, rats, squirrels, hares, and other vermin that work havoc among trees of all sorts, especially during their early growth. I for years farmed land, much of it adjoined on two sides by underwoods, in which were properly reared and fed from five to eight pheasants per acre, my crops escaping with scarcely appreciable damage from them. I believe if all the before-stated vermin could be annihilated, except hares, which might be tolerated to the extent of one to ten acres for coursing and hunting, that the winged game properly reared and fed would be tolerated by the farmers, and all the outcry about the game laws end, unless with those silly poachers' friends, who must have something to talk about.—*L. P. L., in "Agricultural Gazette."*

Rats in Nurseries.

In a letter printed in the July issue of the *Indian Forester*, Mr. Sparling asks for information regarding the best means of meeting the ravages of rats in nurseries.

As far as I am aware, no practicable and really efficient method has yet been devised for exterminating rats, and for this reason they have always been in every country the most formidable enemies of the young forest. The usual method of sprinkling amongst the trees to be protected other species which are preferred by the rats in the expectation of their eating the one and sparing the other, is wholly insufficient when the rats are in large numbers. Traps cannot be set in sufficient quantities to catch all the rats. Poisoning is the best plan, but is objectionable because cattle may be poisoned, and has usually been unsuccessful for want of a proper method. All such operations must be performed on a large scale; it is useless to attempt exterminating the rats on a small area, for they will always return from the surrounding country.

My object in writing this letter is to give an account of a method of poisoning employed in open sowings by Forstmeister E. Heyer in Giessen, which appears to me to have many points in its favour; at least it seems to be more systematic than the plans usually adopted. The experiments on the method, which seem to have been on a very large scale, are described at length in the *Allgemeine Forst* and *Jagd-Zeitung* in the numbers for January, 1873, and February, 1874. A full translation of the articles would be tedious to the readers of the *Indian Forester*, but I will do my best to give a *résumé* of the method employed. If Mr. Sparling wishes for more details, and will let me have his address, I shall be happy to give them to him, or to lend him the numbers containing the articles, which are in German, and are well worth the perusal of any one who is interested in the matter of rats.

The two principal points to be known are how to prepare the poison, and where to lay it.

In choosing the kind of poison we must seek to combine, as far as possible, the following qualities :—

(*a*) Cheapness.

(*b*) The power of attracting the rats.

(*c*) Speedy action, so that a small quantity is sufficient to cause loss of appetite and eventual death.

(*d*) The power of resisting the decomposing influence of air and moisture.

(*e*) The property of converting the dead rat itself into poison for the other rats, which are known to feed upon their dead comrades.

(*f*) As the young sowings will eventually be reopened for cattle grazing, the poison should be of such a kind that in the course of time its poisonous property will disappear, that the cattle may not suffer.

The kind of poison which best fulfils all these conditions, except the first, appears to be strychnine, but as strychnine is expensive, it can only be employed in nurseries, and not in the open sowings.

Next to strychnine, phosphorus is the best poison, but it is apt to deteriorate through exposure.

Arsenic (arsenious acid, or white arsenic) is less speedy in its action than phosphorus, but resists the action of the air better.

If a mixture of phosphorus and arsenic is used, the advantages of both are combined.

As our writer lays great importance upon the method of preparing the poison, I will give the directions in his own words. "The proportions of the ingredients are—

Flour	1·00000 parts.
Wheat	1·00000 ,,
Phosphorus	0 01209 ,,
White arsenic	0·01101 ,,
Water	0·46591 ,, *

"The water should be first weighed out and poured boiling hot into a kettle, together with the weighed quantity of phosphorus. This having melted, one-third of the whole quantity of flour should be added by degrees, and afterwards the difficultly soluble arsenic, the whole being thoroughly stirred. The wheat should now be stirred into the paste thus prepared, and the second third of the flour added. The mass will then be of the consistency of a stiff dough, and should be placed in a flat open box, at which several people can stand and knead the mixture of dough and wheat thoroughly with the remaining third of the flour. This should be done in such a way that the single corns, instead of remaining embedded in the mass, separate from one another, each being covered with a crust of the poisoned dough."

"To escape inhaling the injurious vapours of phosphorus, the workmen should, during the process, keep their heads in the air; the vapours will sink in the atmosphere, and will then be harmless."

* The proportions are given in this table in an alarming form. Reduced to English weight, they are for each pound of flour and of wheat, 84½ grains of phosphorus, 77 grains of arsenic, and 8 ounces of water.

If strychnine is employed, apparently wheat alone is used, without the flour. The wheat must be germinated, and then soaked in the solution of strychnine, and finally roasted. The poison is by this means brought into the interior of the grains. This is important, since it appears that the outer portion of the grain is gnawed off by the rats, and only the inner portion is eaten.

I would remark that the stirring and kneading of the poison ought to be done, not with the hands, but with wooden utensils.

As regards the laying of the poison, two points are considered important: first, the poison must lie where the rats are likely to find it; and second, the places must be easy to find again when fresh poison has to be laid. Several methods are recommended, but the one generally employed was that of digging small channels or passages at a distance of about 25 feet apart over the whole area of the sowings. These channels were lined on each side by narrow strips of turf; the poison was placed in these on pieces of wood or brick, or on stones, which served to keep it dry, and the channels were then roofed over with boards or bricks.

Another plan suggested is to lay the poison in perforated bricks placed in groups, several together, each group being covered with twigs of some species of tree for which the rats have a preference, as for instance, in Europe, willow or hornbeam.

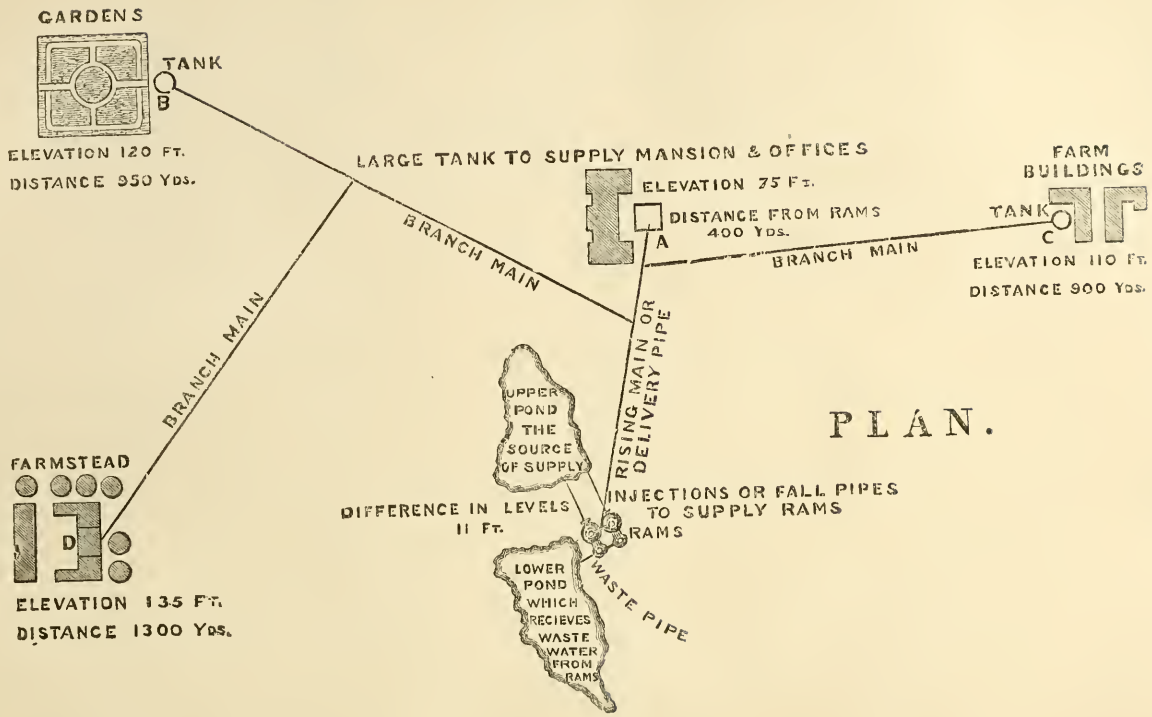
I would, however, suggest that, as Mr. Sparling's rats burrow in the ground, the poison would be best laid in the burrows.

There is a long statement of cost attached to the articles; it will be sufficient for me to state that the average cost reduced to Indian coinage and measure was roughly about Re. 1-4 per acre, of which about one-third was for preparation of the poison, and the remainder for laying it out.

A third article, stating the results of the experiments, was promised, but has not yet appeared.

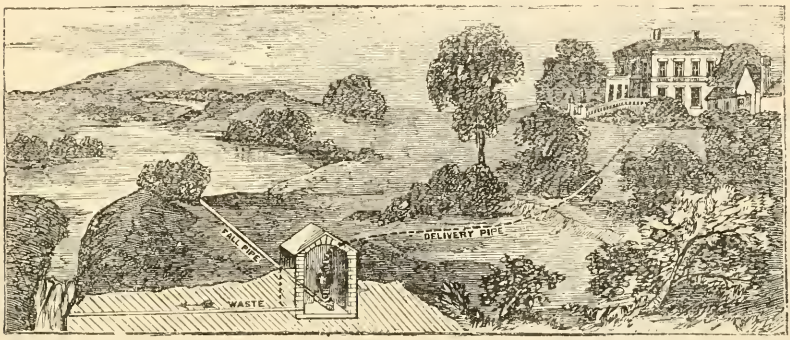
Rats which burrow in the ground, as most if not all of them do, may also be smoked. The ingredients of the smoking mixture are saltpetre, sulphur, and tar, mixed up with sawdust, but I am unable to give the proportions. On the day before the smoking takes place all the rat-holes should be filled up with rubble. Fresh holes will then be formed, and into these burning lumps of the mixture should be introduced. The holes must then be trodden to again, and closed with lumps of turf or stones.

In conclusion, I would express a hope that if Mr. Sparling adopts any of these methods he will publish an account of the results of his work in the *Indian Forester*, since the subject is an interesting one to many, both in India and in England.—*G. A. Hight, in "Indian Forester."*


GARDENS
TANK
B
ELEVATION 120 FT.
DISTANCE 950 YDS.
LARGE TANK TO SUPPLY MANSION & OFFICES
ELEVATION 75 FT.
DISTANCE FROM RAMS
400 YDS.
A
FARM
BUILDINGS
TANK
C
ELEVATION 110 FT.
DISTANCE 900 YDS.
BRANCH MAIN
BRANCH MAIN
BRANCH MAIN
RISING MAIN OR
DELIVERY PIPE
UPPER
POND
THE
SOURCE
OF SUPPLY
PLAN.
FARMSTEAD
D
ELEVATION 135 FT.
DISTANCE 1300 YDS.
DIFFERENCE IN LEVELS
11 FT.
INJECTIONS OR FALL PIPES
TO SUPPLY RAMS
RAMS
LOWER
POND
WHICH
RECIEVES
WASTE
WATER
FROM
RAMS
WASTE PIPE

Improved Self Acting Hydraulic Ram.

We give herewith two illustrations of an improved self-acting hydraulic ram, specially designed by the manufacturers, Messrs. S. Owens and Co., of Whitefriars Street, London, for supplying water to estates, mansions, farms, &c. The specialities of this apparatus are that it is constantly at work without requiring any attention, and that it entails no cost for labour or motive power, the only desideratum being a fall of a few feet. To obtain this it is not always necessary to connect with a running stream, as a head of water from which sufficient fall may be obtained can often be secured from a lake or pond, or by damming up a brook or spring.



The landscape sketch shows a ram supplied by a fall of water from a lake, and forcing up to a mansion at an elevation, the waste water expended in working the ram being carried off to a lower level and into the natural channel which the overflow of the lake finds for itself.

The plan on the opposite page shows a position in which Messrs. S. Owens and Co. have fixed two of their hydraulic rams on an estate, and it will serve as an illustration of the advantages derivable from this simple mode of raising water. These rams have been in constant work for between six and seven years, with but an occasional and trifling cost for new valves, which are inserted by the man in charge. From 3,000 to 6,000 gallons per diem are raised in a variety of directions to different elevations, and through a very considerable length of pipe to tanks at A B C and D; the estate is thus well supplied with water, practically without any expenditure of labour.

The cost of the hydraulic ram and appurtenances is so moderate as to be within the reach of all requiring water to be raised to an elevation where the position is suitable. It is indeed, we believe, the least expensive of all appliances for raising water, both in original outlay and wear and tear, a new valve only being occasionally required, which can be easily secured in its place by any intelligent man, and which costs a mere trifle. A constant supply of water may thus be depended upon, without any cost for labour or motive power, wherever (as is frequently the case) good water upon an estate is running to waste, which might readily be made, before so doing, to form its own motive power in propelling a good portion to points where required.

Forest Fires in America.—The news from America of late tells of dreadful ravages of forest fires in the New England States, and the States of New Jersey, New York, Ohio, and Pennsylvania, and also in Canada and New Brunswick; in fact, there appears to be almost a continuous conflagration of the forests throughout the north-east part of the United States and the lower parts of Canada. The railway traffic is interrupted in many places, and a great number of dwelling-houses, farms, mills, &c., destroyed, causing great suffering and destitution amongst the rural population. The favourite summer hotels on the White Mountains, in New Hampshire, are in great danger of being consumed, large portions of the surrounding forests being in a blaze. The air is filled with fire and dense smoke, and the whole country is brilliantly illuminated at night by the glare of the flames.

Lovers of noble trees, and especially of those which have artistic associations, observes the *Athenæum*, will regret to learn that one of the magnificent elms in front of the Manor House at Chiswick, a tree which Pope and Hogarth must have known quite well, and which the latter drew in the etching styled "Mr. Ranby's House at Chiswick," was blown down in a late gale. Mr. Ranby was Serjeant-Surgeon to the king; he attended Sir R. Walpole in his last illness, and is said to have sat to Hogarth for the hero of "A Rake's Progress," probably in the marriage scene. He was much in the confidence of George II., and attended at the battle of Dettingen; he is often mentioned in memoirs of the time, and was buried in Chelsea Hospital, near Cheselden.

Erratum.—Mr. James Gordon, of Rossdhu, writes us that a mistake occurred in the Table of Comparative Prices published in our last issue. He says that he did not intend to represent the Rossdhu Estate as realizing £4 for larch bark to be "cut and peeled by purchaser." Though a good deal of larch is peeled annually on the estate, it is done to lighten the carriage of the wood; consequently larch is not sold for barking purposes; but as the barking of it is amply repaid by the price the bark realizes, and as the cost of conveying the wood to market is thereby greatly diminished, a little more is naturally expected for the wood when selling it to be cut during the barking season.

The *Banffshire Journal* says that the young trees in about two acres of a plantation at Tomsfores, Kintore, Aberdeenshire, were recently destroyed by fire. It is supposed that the fire may have been caused by a spark from a railway engine.

Prices of Timber at North Carmarthenshire and Cardiganshire.—Excepting cordwood, home-grown timber has sold well this spring, especially larch of moderate dimensions. The price of pitwood ranges from 18s. to 28s. per ton according to quality; cordwood is difficult to sell at from 12s. to 14s., so in some cases where cartage is heavy barely pays expenses; bark sells readily from £5 to £6 per ton, and judging from present signs is likely to maintain its price; alder for clogwood sells from 7d. to 9d. per foot; ash being scarce sells from 1s. to 2s. per foot; oak timber of good quality being difficult to obtain, sells from 1s. 2d. to 2s. 6d. acording to quality and dimensions.—*D. P. Davies.*

THE japan varnish tree has been planted in great numbers in the Paris parks. It resists the ravages of dust and storm better than other trees.

THE estate of Killiemore, in the parish of Penninghame, and county of Wigtown, about six miles from Newton Stewart, has been bought by Mr. A. F. Tweedie, London, for £9,200. The estate is about 481 acres in extent, and the present rental is £266, exclusive of the mansion house, which is let at present along with the shooting at £175 per annum.

A HIGHLAND FOREST FOR THE QUEEN.—It is stated that the arrangements are almost completed for the purchase by Her Majesty from Colonel Farquharson, Invercauld, of the Forest of Ballochbine, which adjoins the estate of Balmoral. The forest is on the estate of Invercauld, and comprises within its bounds the largest area of natural grown Scotch firs in Scotland. It is unequalled for the size, beauty, and symmetry of the trees. Ballochfine has been held by the Queen on lease for a number of years, at an annual rent of £1,500 sterling.

APPOINTMENTS.—Mr. Andrew Rutherford, forester to the Duke of Roxburgh, has been appointed manager on the estate of Snettisham Hall, Lynn, Norfolk. No man can be better qualified for such a situation than Mr. Rutherford, as he is possessed of considerable practical experience gained both on the Roxburgh estates where he has been for eleven years, and on the Oxnam and Jedwater estates of the Marquis of Lothian. Mr. Rutherford carries along with him the good wishes of a very large circle of friends, who showed their appreciation of his worth by presenting him with a valuable testimonial consisting of a gold watch and chain, &c., and a purse of gold, on his leaving Roxburghshire.

MR. JOHN KIRK has been appointed gardener to Lord Bolton, Bolton Hall, Yorkshire.

WE extract the following interesting facts concerning the production of amber from the *Revue des Eaux et Forêts*, for September last:—"Yellow amber, which Eastern nations use so much for rosaries, beads, and mouth-pieces of pipes, is a forest product. An analysis made by Schrutter gives the following results:—Carbon, 78·82; hydrogen, 10·23; oxygen, 10·90. This composition sufficiently proves the vegetable origin of amber, if, indeed, it were not otherwise established by its structure and by the circumstances under which it is found, that it is nothing more than a resin modified by long burial in the soil. The amber which was formerly found on the coast of Sicily appears to have been completely exhausted. It is now the shores of the Baltic that supply the whole world. These coasts were once covered with vast resinous forests, which have left numerous deposits of resin in the soil, and these deposits are at present actively worked. In some places amber is obtained from excavated mines, but more often pieces borne by the sea towards the shore are fished up with nets. Several steamboats are employed on this trade on the coasts of Konigsberg. The right of amber collecting is a royalty in Prussia. It brings a revenue of 600,000 francs (£25,000) annually to the State. Amber is not the only fossil resin used in industrial art. We published in the number for May, 1876, a notice of the gum copal, which is the produce of several *Hymeneas*, and of *Eleocarpus copalifera*, which is found in abundance in the forests of Eastern Africa. New Zealand also furnishes a quantity of an important resin secreted by the 'Kauri' pine (*Dammara lanceolata*). This resin drips on to the soil, where it forms accumulated masses, which are now extensively worked. Kauri resin is used in the manufacture of varnishes, and is worth at Auckland 1,250 francs (£50) per ton."

Bread from Wood.—In an article on Dietetics in No. CIV. of the *Quarterly Review* there is an account of an experiment made by a German professor to utilize wood as a bread-making substance. To make wood flour to perfection, the learned experimentalist said, the wood, after being stripped of its bark, was to be sawn transversely into discs of about an inch in diameter. The sawdust was to be preserved, and the discs beaten to fibres in a pounding mill. The fibres and the sawdust, mixed together, were next deprived of everything harsh and bitter soluble in water by boiling or by subjecting them to the action of cold water, which was done by enclosing them in a sack and beating the sack with a stick or treading it with the feet in a rivulet. After this pulping operation, the dust and fibre were completely dried, either by the sun or by fire, and repeatedly ground in a flour mill. The ground wood was next baked into small flat cakes, with water rendered slightly mucilaginous by the addition of some decoction of linseed, mallow stalks and leaves, lime tree bark, or any other similar substance. The professor preferred marshmallow roots, one ounce of which rendered eight quarts of water sufficiently mucilaginous, and these served to form four pounds and a half of wood flour into cakes. These cakes were baked until they were well browned on the surface, and afterwards broken into pieces and ground until the flour was sufficiently pulverized to pass through a fine bolting cloth; for on the fineness of the flour depended its suitability for bread-making. The flour of a hard wood, such as beech, was found to require the process of baking and grinding to be repeated. The wood flour, it was found, did not ferment so readily as wheaten flour, but the professor ascertained that fifteen pounds of beechwood flour mixed with three pounds of some wheaten leaven and two pounds of wheat flour mixed with new milk, yielded thirty-six pounds of very good bread. The learned gentleman first tried the nutritious qualities of the produce of his wood flour upon a young dog; afterwards he fed two pigs upon it; and then taking courage, he attacked himself, in the form of gruel, soup, dumplings, and pancakes, with as little, if any, other ingredient as possible. The family party which conducted the experiment found the dishes palatable and quite wholesome, but this form of *ligneous farina* does not seem to have found much favour beyond the limits of the inventor's household.—*Miller*,

The estate of Balmuir has been purchased by Mr. John Sharp, of Fernhall, for the sum of £64,000. The estate is situated within two miles of the town of Dundee, and contains 693 imperial acres, whereof about 600 are arable and 50 are underwood.

Ash Trees and Horseshoes.—Mr. Edward Peacock, writing in the *North British Advertizer*, says—"I was informed yesterday that in felling a wood in the parish of Scotton, near Kirton-in-Lindsey, several horseshoes had been found buried under the roots of ash trees. It seemed, said my informant, that a horse shoe had been put into the hole and the young tree planted on it. Have any of your readers ever heard of such a practice, and can any motive, magical or otherwise, be suggested for the custom, if custom it be ?"

The Planes in the Green Park.—The relief of some of these by thinning was effected during the winter, and the trees promise to afford a noble shady grove for one side of Piccadilly in good time. It is to be hoped the rest will shortly be thinned also. A very fine line of young trees has also been planted alongside the drive in Hyde Park. They are planted at distances which will admit of their becoming stately trees and affording pleasant shade.—*The Garden.*

THE terrible ravages committed by insects upon vegetation in this and other countries has claimed and received a considerable share of attention of late amongst scientific and practical men in this country; but not more, in fact not nearly so much as the importance of the subject demands, and we hail with much satisfaction the inauguration in London of a movement amongst agriculturists and others to bring the matter more prominently before the country and the Government, so as to have it thoroughly investigated, and some practical means devised for eradicating the injurious insects which prey upon our crops, and to procure the necessary aid of the Government to enforce the application of proper rules and remedies for the suppression of their attacks when they appear in such vast numbers as to cause serious injury to any of earth's products which are necessary to man's existence and the nation's welfare.

In this, as in several other important branches of national economy, our British Government lags woefully behind that of most other civilized countries, in initiating and fostering a thorough knowledge of the scientific principles which are imperatively necessary to form sure basis from which the devastating inroads of the multitudinous host of insects injurious to the labours of man can be practically and successfully combated. So great is the reproductive powers of many of these predatory pests, and so insidious their attacks on vegetation, that the devastation committed by them too often amounts to a national calamity and causes an incalculable amount of loss, such as the ravages of locusts, ants, and other insect plagues in tropical countries, the Colorado potato beetle and Rocky Mountain locust in the United States of America, and the grape phylloxera in the vineyards of Europe.

Such widespread and deadly attacks on vegetation as those men-

tioned have been much investigated, and are well understood by scientific men, but they require the co-operation and combined action of all nations to thoroughly stamp them out of civilization.

However, there are enormous damages committed within the limited area of the British Isles, and which more immediately concern us, by insects that are quite as injurious to the plants they infest as any of those voracious pests from which our colonies and foreign countries suffer so terribly. It is perhaps only now and again that any particular insect becomes so numerous and deadly in its ravages as to draw public attention to it, and, generally speaking, the amount of ignorance upon the subject of insects and their habits amongst those who have the care and cultivation of plants is truly astounding, when we consider that the possession of a thorough knowledge of a plant's enemies is so often of vital importance to its successful and profitable cultivation. No doubt, some, such as gardeners, have profited by experience, and are fairly well informed upon the nature and habits of the noxious insects which infest their crops, and when their plants are attacked they are in general quite prepared to promptly apply a safe and sure remedy; but the matter is very different with the general run of farmers and foresters, who are notoriously deficient in even the rudiments of a knowledge of such things; for what reason it is not easy to form a conjecture. It cannot be the importance of gardening over the other kindred arts, as on that point we should imagine they stand on a level; neither can it be the comparative value of the crops under the care of the farmer and forester, because these are usually of much more value and consequence to their owners than any garden crop grown in the open air; and we are unwilling to attribute it to either wilful neglect or gross carelessness on their part; so that we must set it down to a want of opportunity of being *taught* to know better.

From an intimate knowledge of both farmers and foresters, we are aware, and must in justice say, that there is fast springing up amongst them a strong desire to improve themselves upon this and all other scientific matters connected with their daily vocations, and it only requires the institution of proper scientific schools of agriculture and forestry to give them an opportunity, of which they would only be too glad to avail themselves, to acquire a thorough knowledge of the science, as well as the practice, of both professions.

The present movement against insects injurious to crops was inaugurated at a special meeting of the Society of Arts, held on the 5th of June, at which there was a large attendance of agriculturists and others interested in the subject, and over which the Duke of Buccleuch, one of the most experienced noblemen and extensive landed proprietors in the country, appropriately presided.

During the course of the meeting Mr. Andrew Murray read a valuable paper prepared by him upon the subject, in which he advocated direct State interference to suppress the ravages of noxious insects, which he supported by convincing evidence of the necessity of some steps being taken to meet the evils of the case; but direct interference by the Government was evidently not in favour with the majority at the meeting, and Mr. Clare Sewell Read went so far as to emphatically declare that in such a matter the Government would be certain to make a muddle, and finished his speech by recommending that the Government be asked not to do anything in the matter!

For our own part we do not see any good reason given against the employment of proper State aid in the suppression of noxious and injurious insects, when we know it is already so extensively applied, and with the very best results, in the suppression of noxious diseases amongst men by the Sanitary Acts, and amongst animals by the Contagious Diseases (Animals) Act; and also what comes extremely close upon the subject in dispute, the laws for the suppression of unwholesome smells or gases injurious to the well-being of the *same* crops which it is desired to protect from the ravages of noxious insects, Already do the farmers submit with grace to the strict enforcement of the Contagious Diseases (Animals) Act, because they are fully aware, from recent and dearly-bought experience, of the great benefit derived from it in the suppression of rinderpest and less fatal diseases amongst their stock; and the dwellers in our cities, towns, and villages do not feel our wholesome sanitary laws to be unbearable to free-born Britons when cholera, small-pox, or fever is raging in their midst; therefore we may safely predict a cheerful acquiescence with any restrictions which the Government may deem necessary for the extirpation of insects injurious to our plants or crops.

There is no insect from which our crops, plants, and trees suffer so detrimentally but that against its attacks science can discover a remedy, and practical men can apply it; but without the aid of proper laws, or State aid to enforce the due application of the remedy on every man's property, it is in vain to think we can extirpate the insects which infest the crops of our ignorant or careless neighbour. Clean our own crops as we may, we can never be safe from the ravages of insects so long as our neighbour is allowed, at his own free will and pleasure, to harbour them in myriads, ready at any moment to make a raid upon the crops which we have been at such great trouble and expense to cultivate in a clean and healthy state for our pleasure or profit.

The same sufficient reason for State interference applies to all branches of cultivation, agriculture, arboriculture, and horticulture;

and from our own knowledge of the vast amount of injury and loss the country suffers annually from the depredations of insects, we believe matters will never be properly remedied until the Government actively interferes to compel the ignorant and careless to take the precautions which the intelligent and thoughtful are ready to do of their own accord.

The amount of State interference, and the manner in which it ought to be carried out, must be left to the wisdom of the Government and the necessity of the case; but we are of opinion that a properly qualified State Entomologist should be appointed (such as has been done years ago in the United States of America with the best results, conspicuously so in the State of Missouri), with a proper staff of assistants distributed all over the country, each having a district assigned to him, such assistants, or local officers, to act as Inspectors of Insects in their respective districts, and to make regular reports to the Chief Entomologist of the noxious insects and the injuries inflicted by them in the district, and to act as superintendents of any operations the Government may consider necessary to rid a district of noxious insects, also giving all necessary information to those whose crops are suffering from the ravages of insects, about the proper remedies, and the best way to apply them. The Chief Entomologist to investigate and report upon all cases of injury committed by insects submitted to him; to advise the local officers in all important points in regard to the nature and habits of any insect preying on plants in their district, giving a clear and accurate description of the insect, its habits, and the mode in which it inflicts injury upon plants, and the best method for its prevention and extermination; all of which should be published in a handy form, and distributed by the local officer throughout the district where the insect has appeared. The Chief Entomologist to collate and summarize all the local reports and official investigations, and publish the same in an annual report for general distribution.

The details of such a plan as we have here indicated can be easily worked out, and we believe it is the best method of meeting a serious national want; and if our authorities desire to study the interest of the nation, they should act promptly in establishing an efficient supervision of the injuries inflicted by insects on the vegetation of the country.

THE extraordinary lateness of the present season has been the subject of general remark, and if it has been prejudicial to early crops, the later growth appears to have been much benefited by being prevented

from pushing into existence before the cold ungenial spring had passed away with its chilling winds and nipping frosts. When at last, towards the first of June, the weather suddenly became mild and warm, vegetation sprung up with a bound, and trees and shrubs literally rushed into growth and quickly covered themselves with a rich mantle of verdant foliage.

The various trees came into leaf with much greater rapidity than usual, and in northern parts the oak especially "jumped into leaf" in a few days, which is held to be a good sign by the forester of the bark stripping nicely and being of good quality.

The ash in many places was much behind the oak in coming into leaf; in fact, in some districts it scarcely moved a bud till the middle of June.

The oak, elm, sycamore, lime, and Spanish chestnut are heavily clothed with luxuriant and healthy foliage, and so far as we have seen have suffered less than usual from the ravages of insects. On the other hand ash, beech, horse-chestnut, poplar and larch are in many districts rather thin in foliage, and the beech in particular has been much infested with the bluish white woolly aphis peculiar to it. Scots fir, spruce, and other coniferæ are making a fine clean rapid growth, and we have not seen or heard of any serious depredations made upon them by insects. However, this month and next are the worst for coniferæ being devoured by insects, and we would recommend our readers to be on the outlook for their appearance among their specimens, and to take prompt means to eradicate them as soon as they are detected.

We regret to hear that the larch aphis has been very bad in some districts during the dry warm weather of last month, and we would be glad if our readers would report any injury observed which has been inflicted by them.

We never remember to have seen such a gorgeous display of late flowering RHODODENDRONS and AZALEAS as has been general in the northern parts of the country during the last few weeks. We have observed them in all soils and situations in which they are grown, and everywhere it has been a complete blaze of white, and crimson, yellow, purple, and lilac, with all the varied shades between. The common rhododendron, *R. ponticum*, and the yellow azalea, *A. pontica* were a perfect sheet of bloom, and would have compared favourably with the highly cultivated and trained specimen Indian azaleas and rhododendrons of greenhouses and conservatories. Of the numerous varieties of Ghent azaleas and late-flowering hybrid rhododendrons there has been an equally profuse display, and those late flowering varieties ought to be extensively planted, as they are almost certain to make a good display annually, and such a treat as they have afforded

this season highly repays those who have had the wisdom and forethought to plant them for the principal attraction amongst American plants in their woods, shrubberies, and gardens.

Several other flowering trees and shrubs have been in many instances particularly fine this summer. The hawthorn generally has been a perfect sheet of snowy blossom, the pink and red varieties being equally fine, but we have observed a good many plants of all the kinds with scarcely a flower. However, amongst all the thorns *Paul's Double Crimson* bears the palm for a rich display and telling effect in the landscape. It is a robust grower and every shoot is loaded with its magnificent rich crimson blossoms, being the nearest approach to a "tree of fire" of any we possess hardy enough to stand our climate. We have seldom seen the laburnum and lilacs so fine, although, like the thorns, some plants were without a flower; but so far as we have seen the horse-chestnut has made a very poor display. All these fine flowering trees and shrubs should be freely introduced along the skirts of woods and plantations, where their effect on the landscape is most pleasing, and in such a season as this would make the whole country in the "leafy month of June" appear as sweet and gay as a modern flower garden, without its tiresome stiffness.

The Bark Harvest being now completed for the season, we are pleased to hear from our numerous correspondents in the various districts of the country that it has been, on the whole, a good harvest, and prices have fully maintained the average of the past few seasons. In the south, where the sap begins to move early, and bark-stripping is usually in full swing early in May, the season has been rather a troublesome and anxious one, owing to the cold and unsettled state of the weather up to the first week of last month; in fact, the severe storm that blew across the south of England on the first day of June was most unfavourable to the stripping and curing of the bark, and caused much damage to it wherever it happened to be exposed to the wind and rain. The changeable state of the weather also rendered the operations very tedious, owing to the irregular rise and flow of the sap, making it necessary to go over the ground two or three times before all the trees could be felled with the sap "up," so as to make the bark run or peel off clean from the timber. Such a tedious season requires great care and close supervision on the part of the forester, so as to select for the first fall only those trees which will strip freely, so as to save the labour of "hammering," or beating the bark with wooden mallets to make it rise, a process that is objectionable in every way, and ought not to be resorted to except under special necessity.

In Scotland and in the north of England, so far as we can learn, the season, although late in beginning and soon over, has been an excellent one, and many foresters have been able to strip and save a large quantity of bark in first rate order. In many places the sap did not flow sufficiently to make the bark run till the first week in June, but genial weather having set in during the last week of May, the sap came away with a rush, and all hands were soon busy felling and stripping with great expedition under very favourable circumstances; consequently, the bark has been saved in a superior condition, and commands a good price in the market.

Our information from Ireland upon the subject is not so full as we hope it will be by another year, but from all we have heard the season has not been too favourable for bark curing in that dripping atmosphere. In the mild and equitable climate of the Green Isle there is generally no difficulty in getting the bark to run freely, but in such a moist climate the curing of it properly is the great obstacle to be overcome, yet with good arrangement and prompt energy and activity, we have seen as fine saved samples of Irish oak bark as we have ever seen produced in Great Britain.

From all the information we have been able to gather, the prices realized for bark have been, as we have already stated, fully up to the average of recent years. In a few cases we heard of a rise of 5s. to 20s. per ton upon the prices obtained a twelvemonth ago, but more report a slight or no advance, although in no single instance have we heard of a falling off from last year's prices. We may, therefore, on the whole congratulate foresters on having had a fairly successful and remunerative bark harvest, although the high war prices that were at one time anticipated have not been realized.

A CONSIDERABLE amount of discussion has been going on of late in reference to the distinctive characteristics of three so-called species of firs,—*Abies Englemanni*, *A. Menziesii*, and *A. Parryana*, the difference between which is made out to be sufficiently distinct and permanent to justify naming them, for all useful purposes if not botanically, as perfectly distinct kinds, *Abies Parryana* being the most suitable of the three for the climate of this country. The *Gardeners' Chronicle*, commenting upon the subject, says: "We have just seen and compared in the Knap Hill Nursery the three firs, including *Abies Parryana*, respecting which a discussion has been going on in our pages since we took occasion some time ago to mention the peculiar beauty of a plant of the latter from Professor Sargent's garden, which was then, and is now, in Mr. Waterer's

possession; and, having carefully examined them all, we have no hesitation in affirming that for all garden purposes the three plants which have been mentioned are perfectly distinct. We speak of their vegetative organs only, not having had the opportunity to examine cones of the recent acquisition, *Abies Parryana.* We found that the first of the trio to grow in spring—a fatal defect in our English climate—was *Abies Englemanni,* which commenced to grow so early that all its young growth was completely killed by the May frosts, and this happens so constantly year after year in the climate of Knap Hill, that this plant is utterly worthless as an ornamental or useful tree, never growing beyond the state of a miserable scrub. The next to grow was *Abies Menziesii,* which we found a few days ago (June 11) with its young growth pretty well advanced and perfectly healthy, having been developed since the occurrence of the frosts which cut up *A. Englemanni.* Latest of all was *Abies Parryana,* which had scarcely yet made any development of its young growth, from which fact it may be concluded that it is practically safe against damage from spring frosts, since it remains quiescent till the risk of spoliation from these is past. We have used the name *Abies Parryana* because the plant appears to be sufficiently distinct to bear a separate designation, its aspect being quite different from that of the other two, irrespective of colour (which varies in degree in different plants), being smaller in its parts and much less coarse-looking than either; while it certainly has not the deflexed footstalks so conspicuous in *A. Menziesii,* though it has the pungent mucro, with somewhat less rigidity, perhaps, characteristic of that plant." *Abies Parryana* is undoubtedly the hardiest and most elegant of the varieties of *A. Menziesii,* even if it does not prove to be a distinct species of fir, and collectors of choice coniferæ, as well as those who are planting for ornament, would do well to look after it. It is not at all desirable to add to the complication of names amongst coniferæ, and when a name is once applied to a *species* it ought never to be altered, except in very urgent and exceptional cases, when it can be proved beyond a doubt that it will be an advantage to science to change the name. The same should be the case in regard to *varieties* of a species; but it cannot at all times be so easily kept in view, owing to the influence of climate, soil, and other external agencies, which may, and often do, alter the character of a *variety* so that "its own father would not know it!" so that the utmost caution should always be taken in naming a *variety* as *new,* when by removal to another locality, with a different soil and climate, it may turn out to be only "an old friend with a new face."

MANY of our readers must be aware of the existence of numerous very old and picturesque trees, or of trees remarkable for their great size, rarity, or beauty, growing in out-of-the-way parts of the country, or in secluded nooks of our forests, where they may have flourished for ages almost unseen and totally unrecorded, few people having the opportunity to observe them, or even to know that such noteworthy trees exist in the locality. The history of such trees is always a most interesting subject, and of great value to science as well as to practical forestry.

We are anxious to collect and publish as much correct information as possible in reference to such remarkable trees, and we would specially invite all who have the opportunity to communicate to this Journal a note of the history, age, size, &c., and the peculiarities of any old or remarkable trees of which they may be cognizant, giving as many particulars as possible relative to the history or traditions that may be connected with the trees; the localities in which they are growing; the soil, subsoil, and drainage; exposure and altitude above the sea; the height of the tree and height of the stem to first large fork or branch; the circumference of the stem at 1 ft., 3 ft., and 6 ft. from the ground; the spread of the branches; the general condition of the tree; its probable age, if the exact age is unknown, with any other particulars of its habit and character which may be noteworthy and interesting.

By this means, with the assistance of our contributors, we hope to be able to amass in our pages a highly interesting and valuable store of facts and incidents in reference to the history and present condition of the finest and most remarkable trees in the country, which will ultimately be of much service to the science of forestry, affording a lasting record for comparison of the growth and longevity of our forest trees, and the conditions under which are produced the most picturesque specimens, or finest timber trees.

The Timber Supply of North America.

By D. SYM SCOTT, Forester, Ballinacourte, Tipperary, Ireland.

America was once supposed to contain sufficient forest produce to afford an unlimited supply of timber for an indefinite period. Pennsylvania, New York, Maine, Ontario, Quebec, Nova Scotia, and New Brunswick, at the beginning of the present century were in reality impenetrable jungles of primeval forest, the haunt of the wandering red Indian, and of the grizzly bear. Now, however, by the unremitting energy of the early squatter these provinces and States are reclaimed to a perfect El Dorado of agriculture, surpassing in many instances the most successful results of the Old Country.

In the country there are what are called "Timber Limits," within which all the pine is reserved, except what the settler requires to assist him with his improvements. Licenses are issued to timber merchants, enabling them to fell and remove the timber.

The policy in regard to timber licenses creates distrust in the minds of squatters, as the restrictions contained therein imbue them with the notion that after taking up their lot of land, timber men may come across their farms, and irretrievably ruin their hard earned improvement, which makes some feel the timber license a great grievance; but when land is bought under certain conditions no injustice is done in having those terms fully carried out. By this system the Crown Land Department is able to counteract a species of fraud practised by squatters pretending to take up a lot of well-timbered land, pay one instalment of the purchase money, chop, and remove the timber, and then abandon the lot.

In some of the districts in Upper Canada the squatters are anxious to have all timber licenses removed from actual settlements, squatters to buy the timber with the land, pay cash down at time of location, and be entitled to dispose of or conserve the timber as their exigences may necessitate. On the other hand the question comes up whether the advantage to the country by one system would be greater than by the other. Many are of the opinion that it would not, because the lumber men are the great pioneers of civilization, as the farmer advances the woodman retires further back

into the depths of the woody wilderness. Besides, the lumber merchants construct roads, put up mills, make canals, and deepen the beds of streams, no doubt for their own benefit actually and immediately; but such works being permanent improvements, are and ultimately of paramount utility to the squatter.

Among the forest trees indigenous to North America are found:—*Pinus strobus, P. resinosa, P. mitis, P. Banksiana, Abies nigra, A. alba, A. Canadensis, Picea balsamea, Larix Americana, Quercus alba, Q. rubra, Q. bicolor, Q. ilicifolia, Fraxnus Americana, F. pubescens, F. sambucifolia, Fagus ferruginea, Carpinus Americana, Tilia Americana, Ulmus fulva, U. racemosa, U. Americana, U. alata, Platanus occidentalis, Acer. rubrum, A. saccharinum, Betula excelsa, B. alba, B. pumela, B. papyracea, B. lutea, Alnus viridis, A. serrulata, A. incana, Populus tremula, P. balsamifera, P. grandidentata, Salix nigra, S. discolor, S. candida, S. longifolia, S. livida,* &c. &c. not forgetting the mammoth *Wellingtonia gigantea* found growing in sheltered valleys on the solitary slopes of the Sierra Nevada, California, near the head waters of the Stanislua and San Antonia rivers, and at an elevation of about 5,000 feet above the level of the sea.

Of the pine tribe—there are the white pine, *Pinus mitis,* and the red pine *Pinus resinosa;* but the white pine is called *yellow* pine, and is by far the most useful and the most valuable of all the trees in the American forests. In the early ages this tree had a very wide location. In the prairies of the Far West, when trees are found, they are only growing on bluffs contiguous to streams, the huge pine logs found below the surface of the ground, afford strong evidence that the tree reigned supreme at one time over the whole of the Northern States. The only feasible surmise which can now be adduced for its disappearance in those regions is that the red Indian having no occasion to build houses or railroads, being satisfied with "wigwams" of skins, and being entirely ignorant of the commercial value of timber would, to satisfy his own gratification, or to illuminate one of their carnival festivals, set fire to, and burn tracks of pine forest as large as Britain, the resinous nature of the timber facilitating its destruction.

This pine is called in the vernacular of the country "monarch," and being found growing in clumps surrounded with trees of inferior quality, the appellative "aristocracy" and "democracy" majestically and commercially are most appropriately applied. These clusters of pine are usually found growing on the banks of rivers and streams everywhere intersecting the country.

In finding out and cutting the timber, the operations are carried out in a thoroughly methodical manner. The great lumber merchants in the country—the word "*lumber*" is applied to the trade gene-

rally, and does not imply any particular kind of wood—seud exploring parties up the rivers in flat bottomed boats with lots of provisions, in search of pine timber. When a cluster of pine is discovered, one of the men, an experienced hand, climbs a hemlock tree selected as a look-out, from the top of which he can scan the dark foliage of the pine, and estimate its probable extent, conveying to his companions on the ground by means of arranged signs the various directions in which the timber extends, which are carefully mapped out on paper. After satisfying themselves of the breadth of timber thus discovered, the expedition retraces its steps homewards, the men blanching trees on the route to enable them to return to the spot without difficulty, when the season for felling operations comes round.

In the fall workmen hired by the lumbermen are dispatched to the woods provided with large quantities of provisions, horses, or oxen, meadow hay, axes, sledges, and all requisites necessary in lumbering. The men, on reaching their destination, select a suitable site for camping. The camp or shanty is rather a crude domicile. When not absolutely a tent, it is erected with logs squared on two sides, upper and under ; the roof is composed of split timber, bark, and hemlock branches. A large aperture in one end of the roof serves in the double capacity of chimney and window. Within, a raised platform constitutes the general bed.

In this primitive, but, when the men possess taste, cosy cabin, the workmen eat, sleep, and enjoy their hours of rest. A cook is told off for every fifty men. The food consists of tea, coffee, corn-bread, molasses, cakes, pork, and white-bush beans, and such fare is at all times abundantly served. Work begins at sun-rise and continues until dark, when the men return to the shanty, where they enjoy their monotonous but yet nutritious food.

Convenient to the men's shanty are booths put up for the teams; these are both warm and comfortable. Men are specially in charge of the animals, to see after their wants, to prevent the one injuring the other, and to repel any attack of wild beasts, large numbers of which are continually prowling about in the neighbourhood of shanties.

The squad of lumbermen is divided into three gangs—choppers, sawyers, and loggers, each having their own distinct duties to perform. The choppers are very particular in selecting axes the shape of which, and method of working, form national characteristics. A North West chopper prefers a long blade, rather round in the face with the weight centered in the eye. Catching hold of the extreme end of the handle he delivers his blows from directly over the left shoulder. A Maine woodsman accepts only a long narrow headed axe; in New York the blade is rather broad and crescent shaped. The Canadian axe has a broad square blade with a short handle.

Choppers are very particular with the edge of the axe, keeping it keen but never ground thin, the shoulders being sedulously preserved to throw off the chip at each stroke. Sometimes a man is employed as sharpener to the whole camp.. But as a rule each man prefers to keep his own tool in order. Sunday is the great day for such odd jobs; such as repairing sleds, clothes, boots, &c., &c.

Before commencing to chop, the tree must be examined carefully to accurately ascertain its natural fall, so that when it falls it neither damages the timber nor disarranges the work. This is important, as trees of such height, if cut irrespective of incline, split long before sufficiently weakened to snap clean off the butt, a mishap destroying the best part of the log. Should a tree break in the middle the choppers square the one end and the sawyers the other. However, it is seldom a tree falls awkwardly, as the direction of the fall is well calculated and carried out with great precision.

Having learned the necessary preliminaries previous to commencing, the chopper—who does not confine himself to any particular distance from the ground, but at such a point as best suits his own ease and convenience, usually about eighteen or twenty inches from the ground—begins to chop away until the monarch which has stood defiantly the hurricane for centuries shows symptoms of weakening, by oscillating. When this is observed the experienced chopper seeks a safe retreat while the tree moves away, steadily increasing in speed as it nears the ground, where it falls with a crash, awakening all the dormant echoes of the uninterrupted quiet every where prevailing, reverberating from tree to tree under a clear frosty atmosphere, the sound dies away in the lone distance with a moan.

Following the choppers are sawyers preparing the trees into logs for transit to the nearest stream. A suitable spot is selected as a "roll-a-way," where the logs are fixed on a sled to which a team of oxen—oxen are preferred to horses—is hitched and away glides the trail over the hard crisp snow lying on the track. A pair of ordinary good horses will haul with ease a log containing 3,500 feet of inch lumber. The use of the sled under the end of the log is obvious; it facilitates the removal and slides over any unseen obstruction lying beneath the snow.

When the logs are not drawn directly to a saw mill yard, they are collected on the sides of streams awaiting freshets to remove the ice and swell the river to allow a "drive." On small rivers the logs are hurled in one by one as they have often to pass falls and rapids. At such places "jams" are of frequent occurrence by the accumulation of several hundred logs. To prevent "jams" requires great expertness and agility. Breaking up a "jam" is a dangerous and arduous undertaking often accompanied with loss of life. The men employed keeping

the timber on the run are all expert and experienced hands. They are furnished with iron spikes in their boots to enable them to stand on a log in the water while breaking up a "jam."

At "driving," work begins at 4 o'clock a.m. and ends at 9 p.m., the men receiving five meals a day. As soon as the falls are all passed and the river becomes navigable the material is collected and rafts constructed which are either taken in tow by boats manned by lumbermen, or placed in charge of experienced rivermen who hoist sail.

On some of the rivers where there are impediments to navigation "slides" are constructed through which the timber passes. At the entrance and discharge ends of these slides "booms" are erected to receive the timber, such works being usually kept in repair by the Public Works Department, and tolls are charged on timber passing through them.

Every log is measured as it leaves the forest and enters the saw mill yard, and the contents returned as so many feet of lumber. A staff of officers are appointed for this purpose called "Cullers" who mark what they inspect with their initials, and the letters M for merchantable, U for merchantable quality but under size, S for second quality, and R for rejected. The mark to be on the end of all lumber except boarding.

Legislation has made stringent provisions for the punishment of persons taking illegal possession of timber, and appropriating it, and for defacing the trade marks,—the presence on a piece of timber of a registered mark is *prima facie* evidence that it belongs to the person or company who have registered it, and throws the burden of proof on the person in whose possession it is found that he is the lawful owner thereof.

The foregoing is briefly the *modus operandi* of lumbering as carried on in America and Canada. I will now proceed to give the census of the great timber centres east of the Rocky Mountains. Commencing with Nova Scotia. There is not much timber left in this province. At the present rate of consumption it will last only a few years. The forest produce in 1871 was square white pine 288,638 cubic feet; square red pine, 22,020 cubic feet; square oak, 96,494 cubic feet; larch, 116,816 cubic feet birch and maple, 518,272 cubic feet; elm, 200 cubic feet; walnut (soft), 2,265 cubic feet; hickory, 250 cubic feet; all other timber 3,088,003 cubic feet; pine logs, 477,187; other logs, 897,595; masts and spars. 10,631; staves, 11,811 thousand; lathwood, 924 cords; tanbark, 12,388 cords; firewood, 1,579,416 tons. Nova Scotia has 1,444 saw mills of an annual value of £66,000 and producing articles to the value of £279,000 per annum.

Considerable timber still remains in New Brunswick, about 27 acres per head of the population, but a large per centage of this

quantity is composed of spruce. The produce in 1871 was pine, 391,051 cubic feet; oak, 7,360; larch, 360,825; birch and maple, 827,315 cubic feet; elm, 1,250 cubic feet; walnut (soft), 120 cubic feet; all other timber, 2,192,608 cubic feet; pine logs, 1,214,485; other logs, 3,533,153; masts and spars, 11,356; staves 747 thousand; lathwood, 2,490 cords; tanbark, 28,228 cords; 545,679 cords of firewood equal to 1½ million tons. The number of saw mills in the same year was 565 with a yearly value of £280,000. The value of articles produced per annum is £1,315,000.

The forest produce of Quebec same year is returned at 9,232,575 cubic feet of pine; 15,085,511 cubic feet of other wood; 5,811,532 pine logs; 3,628,720 other logs; masts and spars, 94,822; staves 1,184 thousand; lathwood, 7,148 cords; tan bark, 91,051 cords, and 9,364,836 tons of firewood. The number of saw mills is 1,708 at a yearly value of £367,000, producing articles to the value of £1,800,000.

Ontario produced in above mentioned year 16,315,901 cubic feet of pine; oak, 3,144,554 cubic feet; larch, 1,223,444 cubic feet; birch, and maple, 92,200 cubic feet; elm, 1,777,905 cubic feet; black walnut, 117,589 cubic feet; soft walnut 72,214 cubic feet; hickory, 157,745 cubic feet; all other timber 10,594,943 cubic feet; pine logs 5,713,204, other logs 1,255,090; masts and spars, 20,964; staves, 20,964, thousand; lathwood, 15,095 cords; tan bark, 30,854 cords, and 13,548,000 tons of firewood. Saw mills 1,837, producing articles of a yearly value of £2,500,000. There are 4 saw and file cutting mills, 7 match factories and 22 charcoal burning establishments.

The State of Maine with eighteen acres of timber per head of population has 1,099 saw mills, manufacturing annually 639,167,000 feet of inch boards. The annual cut in this state of all kinds of timber is estimated at 1,000,000,000 feet of inch lumber. Much of this is spruce of inferior quality. Twenty years it is said will exhaust the supply.

New York having 3510 saw mills, saws about 1,300,000,000 feet of inch boards, and like Maine much of it is spruce growing in the Adirondack district. Comparatively little pine is now found in this State and the supply is supplemented with large consignments from Canada, Maine, and the Western States.

When old Penn settled in Pennsylvania it was indeed a rich sylvania, with forests supposed to be inexhaustible, but the prospect has changed and the supply of timber will, in a few years, be inadequate to the demand for home consumption. The number of saw mills is 3,738, sawing 1,610,000,000 feet of boarding. About 500,000,000 feet is pine, the remainder hemlock, and only such as can be weeded out of the stock preserved by squatters for fuel. This State was once the best pine producer in America, but now the Susquehanna, Monongahela, and Alleghany forests, are all but robbed of their majestic pines.

The whole of the forests of the other Eastern States are practically exhausted. New Hampshire, Ohio, Indiana, Delaware, Massachusetts, Connecticut and Rhode Island, have barely enough to supply the population with fuel.

The Southern states, Mississipi, Kentucky, Alabama, Tennessee, Florida, Georgia, Arkansas, Lousiana, and the Carolinas, have large tracts of pitch pine (*P. Australis*) and cypress (*Taxodium*) amounting to 11,000,000,000 cubic feet, representing something like 275,000,030 tons of rough timber. The timber imported into Britain from the Southern States is in point of value held at a low ebb. The turpentine producers are fast slashing down the trees.

The North Western States, Michigan, Wisconsin, Minnesota, and Mississippi river, are the four great timber states east of the Rocky Mountains. They are situated between the three mammoth lakes, Huron, Michigan, and Superior. In 1876 the cut in these states was: Michigan, 2,229,603,993 feet; Wisconsin, 792,544,823; Minnesota, 317,092,000; and Mississippi, 380,067,000; making a total of 3,719,308,816 feet of standing timber cleared. The manufacturing capacity of the saw-mills is 5,680,600,000 feet per annum, or one-third in excess of the amount actually manufactured. The estimate for 1877 is 3,200,000,000 as compared with 1876.

To compare the amount of timber annually cut in these forests, Chicago may be cited as a centre. In the year 1871 there were over 100 saw-mills, and the quantity of timber received from districts directly contributary is given as 1,238,000,000 feet. About half a million is used in the city, the rest is sent west to the immense prairie lying beyond the city, and depending entirely on the east for its timber supply. Rebuilding the city after the great fire took 750,000,000 feet. The stock of the 100 yards on the 1st of February, 1871, was given at: sawn pine, 233,387,527; hewn pine timber, 567,000; lath, 17,550,350 pieces; picket, 1,049,666 pieces; cedar posts, 129,170 pieces; shingles, 60,000 tons; 10,000 acres are annually cleared to supply Chicago alone with fuel.

The following table shows the probable annual cut in the different districts in the great lake regions, with estimate of standing timber :—

	Annual cut.		Quantity still left,	
Lake shore, South of Green Bay.	20	million feet.	. 2	billion feet.
Grand Haven . .	12½	„	. 1½	„
Muskegon . .	300	„	. 2	„
White Lake . .	75	„	. 3	„
Pent Water, . .	12	„	. 1	„
Thunder Bay .	70	„	. 1½	„
Manistee .	180	„	. 7	„

Portage . .	12milliou feet.		½ billion feet.	
Grand Traverse . .	33	„ .	3	„
Monastique . .	12	„ .	3½	„
Ford River . .	16	„ .	1½	„
Menomenee . .	140	„ .	8½	„
Oconto . .	120	„ .	1	„
Peshtigo . .	35	„ .	1	„
Green Bay region .	60	„ .	1½	„
Kewannee . .	10	„ .	1	„
Two Rivers . .	10	„ .	5½	„
Upper Mississippi .	—	„ .	3	„
	1,117½	„ .	48	„

If the above estimate be at all approximate to the correct figures, fifty years will exhaust all the forest on the east side of the Rocky Mountains.

Michigan has 1,571, Minnesota 926 saw-mills. Westward beyond the Missouri there is nothing but a treeless plain entirely dependent on the North West States for its timber supply.

Taking a comprehensive view over the whole country, I find that all the Eastern States excepting Maine, New York, and Pennsylvania, are practically denuded of their timber. The three states excepted have as yet a surplus, but at the present rate of consumption cannot last longer than fifteen years.

The sum total of manufactured timber in America amounts to 12,756,000,000 feet annually, and by adding all timber manufactured and used in private consumption, exclusive of firewood, will pipe up a total of 20,000,000,000 feet. Allowing 600 feet of inch boarding to the ton weight, 20 billions will give 30,000,000 tons; enough to freight every ship, boat, and cobble of the whole world, the aggregate tonnage of which is set down at 18,000,000.

The total number of saw-mills sawing timber is 26,000. There are 63,938 establishments, producing articles made of wood, giving employment to 543,400 hands. By taking the first and second industries, based on the use of timber, the value of raw material used will exceed £150,000,000.

The reader will form a good idea of the enormous consumption of timber in this great Republic from the following items. There are 85,000 miles of railway, consuming yearly 2,000,000 tons of sleepers, a yearly supply of 25,000, tons of telegraph poles, and 125,000 miles of railway fences to keep in repair. From 30,000 to 40,000 acres are annually cut down to burn brick, and 5,000 tons of the very best pine timber are yearly manufactured into matches. Of white birch £100,000 worth is annually cut up into shoemakers' pegs, and about

£5,000,000 worth was in 1873 converted into implements of husbandry. The value of imports of timber from Canada in 1873 was £2,000,000, and the exports of timber from the States in 1876 £2,200,000.

Turning now to Canada and continuing to investigate the timber supply still left in the Dominion, I am informed by the Hon. Wm. MacCraney, M.P.P., a gentleman to whom I am much indebted for many of the figures given in this paper, that there is very little timber left between Lake Huron and Nova Scotia, and it will not last more than a few years. The quantity in New Brunswick is considerable, but in comparison to the quantity used for local purposes and exported cannot hold out long. There is still a considerable tract covered with pine north of the Georgian Bay and Lake Superior, but a large portion of it is very inferior in quality. In the territory west of Toronto and Collingwood there is no timber to spare from home consumption, and even that will not last for the present use and waste more than twenty years. There is no timber in Rupert's Land and the North-West Territory except in the basin of Lake Winnipeg. On the Ottawa river and other small streams north of the Canadian Pacific Railway, there are still large breadths of white and red pine left enough to keep up a supply for at least thirty years. Further tothe north of Georgian Bay, among a chain of small lakes connected with the drainage of the Ottawa river, there are still large tracts of surveyed timber untouched; the revenue from timber dues in this district in 1874 was in round figures £85,000. In the Ottawa, Belleville, and Western district there are about 11,388 square miles surveyed and under timber license.

The timber supply of Manitoba is extensive enough, but consists principally of oak, elm, poplar, and other trees of inferior quality. Still they are useful as firewood, and as the timber belts extend many miles round by Lake Winnipeg and the Lake of the Woods, a supply of fuel can be depended on for many years to come.

Eastwards down the valley of the St. Lawrence, the Eastern Townships, Nova Scotia and New Brunswick, there were from Montreal at one time large tracts of spruce timber. "These forests," says the *St. John's Telegraph*, "were until quite recently regarded by the people as unworthy of protection, but now, when they find that one-half of the best timbered lands have been destroyed, and that a nineteenth of the remainder are worked out, they view the subject with great anxiety." The inhabitants feel and see that their hitherto indiscriminate cutting and slashing has done its work most effectually, and that their supply of *firewood* will soon become limited.

In the Dominion there are 5,254 saw-mills employed lumbering, giving work to 36,668 hands, there are 1,354 shingle mills, 73 charcoal burning, and 74 wood-turning establishments.

The value of exports and home consumption since 1870 is given in the following table:—

	Exports.	Home consumption.
1870	$20,940,434	10,000,000
1871	22,352,211	11,000,000
1872	23,685,382	11,500,000
1873	28,586,816	14,000,000
1874	26,817,715	13,000,000
1875	24,781,780	12,000,000
1876	19,785,000	10,000,000

This statement only includes exports from Ontario, Quebec, New Brunswick, and Nova Scotia. Timber is sold at an average of 3s. per 1,000 ft., board measure, of sawn lumber, and ¾d. per cubic foot for round timber. About 25 per cent. of the standing price is available for square timber, 40 per cent. for sawn logs, and the remaining 35 per cent. is undergirth, useless or damaged timber.

On the Pacific side of the continent there are extensive forests of pine, but like that growing in the Southern States it is of very little value. The timber used in the waggon factories of San Francisco and Sacramento is transported from the Eastern States. Oregon timber lacks tenacity, and is utterly unfit to make even an axe-helve; besides, lumbermen acknowledge that the supply in these regions has always been overstated.

On the western slope of the Blue Mountains a curious method of transporting sawn lumber from the mills to the nearest port is adopted. The agent employed being water, the first consideration is selecting a site to erect the mill where a copious supply of water can be obtained by gravitation. When this can be depended on, the mill and subsequent destination of the timber are connected with a continuous aqueduct, built with boards thirty inches broad, securely nailed on the nether side, forming an acute angle, like the letter V, and substantially supported on cross brackets. The trough is filled with water from a diverted stream. The speed in a grade of one in 100 is calculated at eight miles per hour, and of course as the incline is augmented the ratio of velocity is also increased. The Chico and Arcado "flume" is forty miles long, and is travelled over in four hours, carrying 110,000 feet of inch lumber per day, equal to 55,000 tons per annum.

Reverting to the assumption that the timber supply in the Eastern States and Canada will be totally exhausted in fifty years, the question may be asked, can no remedy be suggested to secure a permanent supply to all future generations? Most undoubtedly there can. The prosperity of the country depends so much on the product of her forests, that it is imperative on the part of the respective Governments

to inaugurate a state and national system for economizing the forests and increasing the product of valuable timber. No country is better adapted to work out a system of practical forestry. By practical forestry, I am not to be taken as meaning the limited system practised on private properties in Great Britain, but the more comprehensive method carried out on the Continent. If the forests were divided into blocks of size regulated according to the kind of tree, age, and local circumstances, each block could be operated on in rotation.

In reproducing forest timber two systems could be followed—the natural and the artificial. The natural system implies simply the replenishing of the ground from seed shed from standard trees specially preserved for that purpose; the artificial system is the plan well known in Scotland of rearing plants in a nursery and removing them afterwards to their final situation: the latter method must of course be employed when it is found necessary to change the crop from hardwood to coniferæ or *vice versa.*

In all this, one thing is evident, America must very soon engage the services of practical arboriculturists to perpetuate her forest capital, or the consequence will prove most disastrous to the future prosperity of the country.

FOREST SONGS AND POETRY.

SPENSER, in the "Faërie Queene," thus enumerates the trees of that era, 1590:—

"And foorth they passe, with pleasure forward led,
Joying to heare the birds' sweet harmony;
Which therein shrouded from the tempest dred,
Seemed in their song to scorn the cruell sky.
Much can they praise the trees so straight and hy,
The sayling Pine, the Cedar proud and tall;
The vine-propp Elme, the Poplar, never dry;
The builder Oake, sole king of forests all,
The Aspine, good for staves; the Cypresse funerall.
The Laurell, meede of mighty conquerors
And poets sage; the Firre that weepeth still,
The Willow, worne of folorne paramours,
The Eugh (yew) obedient to the bender's will
The fruitful Olive, and the Plantane round,
The carver Holme (lime); the Maple seldom inward sound."

On Coppice Wood; its Cutting or Exploitation.

By ALFRED J. BURROWS, OF PLUCKLEY, KENT.

As the permanent productiveness of coppice depends so much upon the time and manner in which cuttings from the stools are made, and its growth in most parts of the country is so highly remunerative, a few remarks under the above head may not be unacceptable to readers of the *Journal of Forestry*.

When we consider the loss arising from the premature decay o stools and the expenses of replanting or filling up, it will be admitted that the greatest possible attention should be bestowed upon the cutting of underwood. In the present paper I propose to deal only with pure coppice, in which no stores or standards are left at the time of exploitation. It is, however, questionable whether a certain proportion of such stores may not be advantageously left in every coppice. In the cider-producing counties, such as Hereford and Worcester, these stores command a high price in the market as "hoop-ash," for making hogshead and larger hoops as well as hurdles; while in Kent and adjoining counties they are greatly in demand as "use-poles," for fencing, and gate or hurdle-making. With careful selection and distribution, also, a proportion of oaks and other stores may remain for three rotations with little injury to the underwood; and the superiority of coppice-grown bark is sufficiently attested by its high price in the market.

Where permanent coppice is intended it is not desirable to leave the standards beyond this period, as reproduction from stools becomes uncertain after the age of thirty-five or forty years. The shelter from frosts which such standards afford to the young shoots of ash and Spanish chestnut is an additional argument in their favour.

To most of your readers it will appear superfluous to observe that amongst trees the broad-leaved species alone are reproductive from stools—the ash, willow, oak, maple, elm, Spanish chestnut, alder hornbeam, birch, and, for a shorter period, the beech. The willow, birch, lime, and some others are also reproduced freely from suckers.

As many of the shoots upon a stool proceed from buds which are called *adventitious*, and which are dependent for their proper develop-

ment upon the close adhesion of the bark to the wood on the upper edge of the cut stool, the importance of clean and careful cutting cannot be over-rated. An adventitious bud appears as an excrescence between the bark and wood at the edge of the severance. When the cutting is made too early in the autumn the wood and bark become separated by the rain and frost, and the formation of buds is checked; the same effect is produced by a ragged or careless cut. The use of too heavy or too blunt an axe or other cutting tool produces the same result. Besides, the shock upon the stool will often sever the smaller fibres and destroy the continuity of the dormant buds. This is more particularly the case with smaller stools and upon loose soils where a light axe or billhook should invariably be used for cutting the smaller poles, binders, withes, &c. It is almost unnecessary to remark that in cutting the larger poles care should be taken not to rend the bark. This can be prevented only by cutting on both sides and directing the blows slightly upwards, so as to leave the stool with a clean slanting cut. Pains should be taken to trim off the stool smoothly and evenly, so as to afford no lodgment for the water. In all except very wet situations the stools should be cut close to the ground. While this favours the development of the adventitious buds in situations where the future branches are not liable to be torn from the stool by high winds or the weight of snow-drifts, it also causes the *dormant* buds to appear from beneath the soil or in close contact with it. The shoots thus formed root directly into the soil, and to some extent become independent of the parent stool, which they also laterally extend, a most desirable end in thinly-stocked plantations.

The *dormant* buds, before spoken of, proceed directly from the medullary rays or processes of the wood of which they are merely an external prolongation. Their position is always below that of the adventitious buds. They are more certain of development from young stools and early cut coppice.

In low-lying and wet situations the stools should invariably be cut so as to favour the production of shoots above the level of stagnant water.

Wherever, from neglect, the stools have been allowed to grow too high they may, however large, be cut back slantingly by either one or two cuts of the saw from the outside of the stool to the centre, and afterwards finished off smoothly with an adze. This, however, is an operation which will require considerable care and judgment.

Where the falls of underwood are large it is a difficult matter to limit purchasers to any particular period of the winter for clearing the stub, but under no circumstances should the time for falling extend beyond the first week in April. Considerable injury

to the stools is also caused by cutting during the prevalence of hard frosts. To ensure an abundance of shoots during the following summer, there is no period of cutting comparable to the month of February and the earlier part of March. The period allowed for clearing the woods often extends to the 1st of June, by which time the shoots upon the stools are often in such an advanced stage that irreparable injury is caused both by horses and wheels. It would better answer the interests of proprietors to provide good roads and insist upon an earlier clearance.

The age at which a coppice should be cut must depend very much upon situation, climate, soil, and the purposes for which such produce is required. Ash and chestnut are often cut at eight, nine, or ten years old, but the small quantity of heartwood contained in such early cut poles and their consequent inferiority should have some influence in checking the practice. From eleven to thirteen years is a much better period, and if some of them become too large for hops they always meet with a ready sale as "use-poles." Oak coppice seldom pays more money than when felled and stripped at twenty-four or twenty-five years' growth.

Upon light sandy soils in some parts of Kent Spanish chestnut thrives so well that it is no unusual thing for an acre to realize nearly £60 at the time of cutting, and this upon land which would be considered dear at an agricultural rent of 20s. per acre.

Where coppice has become thin from the decay of stools or other causes, and it is not deemed advisable to fill up with fresh plants much may be done by the judicious layering of oak branches from the existing stools. All that is required is to trench round the stools to a depth of six inches or more, bend the branches to the bottom of the trench and plash them, peg them fast, fix the soil firmly round them, raise the top of the layer, and cut off at the second eye above ground. This operation may be performed at almost any season of the year.

Where the decay of stool seems to be the result of too long a continuance under one kind of wood it should be borne in mind that oaks will succeed ash and *vice versâ*. Beech also will grow up under the shade of almost any other tree.

In very damp situations an abundant crop of willow will spring up along a track or brushed road where brush of this kind has been placed in the bottom.

In a future paper I shall be happy to furnish particulars of sales of timber and coppice, prices of forest work and produce in this locality.

The School of Forestry in the Polytechnic School of Carlsruhe.

By THE REV J. C. BROWN, LL.D.,

THE Polytechnicum of the Grand Duchy of Baden is in Carlsruhe. It was established with a view to the development and diffusion of technical science and art; and the instruction given is based on the principle that a thorough preparation for any technical calling must be founded on *a mathematischer, natur-wissenschaftlicher, wirthschafts-wissenschaftlicher, historischer, und Kuenstlicher Bildung,* or an education in accordance with mathematics, science, the economical application of this and of art, and a correct acquaintance with history.

It supplies opportunities for acquiring education and instruction in general, and in special sciences and arts, to the engineer, the mechanican the architect, the chemist, and the forester; while the financier, the pharmaceutist, the land surveyor, the teacher of mathematics, and of natural history, and all who have devoted themselves to other industrial occupations than those named, may find in attendance at it appropriate instruction; and students of pharmacy have the option of attending either the Polytechnicum or the University, as a pre-requisite to examination.

The instruction required for different industrial occupations is arranged in accordance with the following divisions:—

1. The School of Mathematics.
2. The School of Engineering.
3. The School of Machinery.
4. The School of Architecture.
5. The School of Chemistry, and,
6. The School of Forestry.

The method of instruction takes the form of lectures, examinations, practice in drawing and in construction, work in the laboratories and workshops, and excursions.

Combined with the Polytechnicum are the following collections by which instruction is aided and sustained:—

1. A cabinet of philosophical instruments.
2. A geological and mineral collection.
3. A zoological and botanical collection.

4. A collection of models belonging to the School of Engineering.
5. A collection of models belonging to the School of Machinery.
6. A collection of models belonging to the School of Architecture.
7. A technological collection.
8. A collection of instruments used in land surveying, &c.
9. A collection of models for use in teaching geometry.
10. A collection of plaster casts.
11. A collection of objects connected with forests.
12. A library and reading-room of science connected therewith.

There are also laboratories :—(1) a chemical laboratory ; (2) a laboratory of natural philosophy ; (3) a mineral laboratory ; (4) a laboratory of organic chemistry ; (5) a laboratory of technological chemistry.

Further :— there is an arboretum, or forest garden ;

And finally, workshops :—(1) for making models in clay ; (2) for making models in plaster-of-Paris ; and (3) for making models in wood.

The Polytechnicum is under the immediate controul of the Minister of the Interior, and is governed by a director appointed annually by the Sovereign, on the ground of his election by the Professors ; a petit council, consisting of the director, his predecessor in office, and three others, elected and appointed annually in the same way, and the grand council, consisting of the collective body of ordinary professors.

The body of instructors, consisting of professors, lecturers, college tutors, and assistants, number forty-nine in all.

There are two sessions in the year: the winter session is from the 1st of October to the 15th March; the summer session from the 15th of April to the 31st July ; and provision is made for profitably employing the holidays and vacations in excursions or tours of observation, with or without the assistance of professors.

The following are the arrangements for study in the School of Forestry during the current year, from 1st October, 1876, to 31st July, 1877 :—

STUDENTS OF THE FIRST YEAR.—WINTER SESSION.

Geometry of solids	3	hours per week
Drawing of plans and diagrams . .	2	„
Botany: morphology, physiology, and cryptogamic plants	3	„
Experimental physics	4	„
Repetition of the same with the assistant . .	1	„
Organic experimental chemistry . .	4	„
Conversational examination on the same .	1	„
Freehand drawing	2	„

SUMMER SESSION.

Arithmetic	3 hours per week.
Drawing of plans and diagrams	2 „
Botany: special natural history of phanerogamic plants	3 „
Botanical excursions and practice in determining plants, from two to three half-days	
Experimental physics	4 „
Repetition of the same with the assistant	1 „
Organic experimental chemistry	4 „
Qualitative chemical analysis	2 „
Work in chemical laboratory	5 „
Freehand drawing	4 „

STUDENTS OF THE SECOND YEAR.—WINTER SESSION.

Plane and spherical trigonometry	2 hours per week.
Analytical geometry of planes	3 „
Drawing of plans	2 „
Practice in the handling and use of instruments used in land surveying, &c.	4 „
Mineralogy	4 „
Practice in mineralogy	3 „
Vegetable physiology	3 „
Use of microscope	2 „
Zoology: general zoology and special natural history of vertebrata	3 „
Work in chemical laboratory	5 „

SUMMER SESSION.

Drawing of plans	2 „
Geology	4 „
Practice in mineralogy	3 „
Practice in agricultural chemistry and vegetable physiology	9 „
Geographical distribution of plants	1 „
Zoology: natural history of invertebrata.	3 „

STUDENTS OF THE THIRD YEAR:—WINTER SESSION.

Differential and integral calculus	4 hours per week
Practical geometry	3 „
Forest improvement and technology	4 „
Forest protection	4 „
Forest soils and climatology	2 „
Forest excursions and practical exercises, Saturdays	
Encyclopædic study of rural economy	2 „
Political economy	4 „

SUMMER SESSION.

Elements of mechanics	5	hours per week.
Exercise in practical geometry, Afternoons		
Agricultural chemistry	2	„
Forest exploitation and history of forest economy	5	„
Natural history of forest trees	3	„
Forest excursions and practical exercises, Saturdays		
Encyclopædic study of rural economy	2	„
Financial science	3	„
History of the German forest policy	1	„

STUDENTS OF THE FOURTH YEAR:—WINTER SESSION.

Forest policy	3	„
Taking up of trees, means of growth, and management of forests	6	„
Excursions in woods and forests, with a view to the establishment and completion of the lectures on the subjects mentioned, Saturdays and free afternoons		
Forest roads and hydraulic engineering	3	„
Encyclopædic study of rural economy	2	„
Popular study of law	3	„

SUMMER SESSION.

Forest engineering and history of forest science	5	„
History of the German forest policy	1	„
Pecuniary valuation of forests	3	„
Forest police	2	„
Forest statistics	2	„
Forest administration and management	2	„
Encyclopædic study of rural economy	2	„
Forest and game laws	2	„
Excursions in woods and forests, with a view to the establishment and completion of the lectures on all the subjects mentioned above, Saturdays and free afternoons		

To students in the Forest School there is recommended moreover attendance in the following classes:—

WINTER SESSION.

Modern history, more especially of Germany, since 1816	4	hours per week.
Modern history of German literature since the death of Schiller	2	„
Hygiene, or preservation of health; anthropological introduction and domestic hygiene	2	„

SUMMER SESSION.

Roman history	4 hours per week.
Lessing's Nathan der Weisse . . .	1 „
Hygiene, or preservation of health; public hygiene.	2 „

The arrangements in regard to admittance, fees, diplomas, holidays, &c., and in regard to hospitanten are similar to those in the Agricultural and Forest College at Hohenheim, though varying in several particulars.

In illustration of the advantages of combining a School of Forestry with other educational arrangements, I may state that there are only two professors of Forest Science in the Polythechnicum at Carlsruhe. Most of the classes not taught by them attended by students of forestry are classes taught in some of the other schools or faculties of the institution. The exceptions are that the Professor of Economics has a special meeting with the students of forestry one a hour week during the summer session, and the Professor of Rural Economy in the University of Heidelberg has a meeting with them for two hours once a week both summer and winter.

A similar advantage is gained at Giesen by connecting the School of Forestry with the University. Where it is desirable to minimize as much as possible the staff of teachers, much may be effected by substituting for several separate professorships one of Economic Botany and Forest Economy.

In connection with economic botany might be communicated information in regard to the differences subsisting between vegetables and animals and minerals; the structure and physiology of plants; the structural development of thallogens, acrogens, endogens, and exogens; the morphology and classifications of plants, with an exposition of the doctrine of evolution; the chemistry of vegetation and the relation to this of soils, manures, heat, and moisture, with the climatal effects of vegetation on the heat, humidity, and chemical constituents of the atmosphere; the chemical constitution of vegetable products, and the preparation of these for use in the arts and manufactures and as luxuries, medicines, or food; the natural distribution of plants and the means of acclimatization, of culture, and of stimulating the production of economic products in roots, stems, bark, leaves, flowers, fruits, or seeds.

In connection with forest economy, instruction might be given as I have suggested in another case in the structure and physiology of trees and shrubs; in the geographical distribution of forests; in

the treatment of forests by *sartage*, by *jardinage*, by *à tire et aire*' by *les compartements*, or the *Fachwerke Methode* of Germany; in the application of this to coppice wood, with a view to securing, along with other advantages, a sustained production of wood; and in the application of it to timber forests, according as the object may be to secure from these a maximum size of timber, or a maximum produce of wood, or a maximum pecuniary return, along with natural reproduction, sustained production, and progressive improvement of the woods; and in measures to be employed in the conversion of coppice wood into timber forest, of timber forest into coppice wood, of mixed woods into either, and of either into mixed woods; instruction in regard to forest economy, forest legislation, and forest literature in Britain; in France and in Germany, countries in advance of all others in forest science, and in the practical application of it to the management of forests; in Russia, where arrangements are being made to introduce and to carry out extensively the improved forest management practised in Germany and in France; in Finland, where arrangements have been made to manage the forests in accordance with the requirements of forest science; in Sweden, where the latest arrangements suggested by forest science are being carried out with vigour; in British Colonies; in America; and in India, where have been introduced many of the suggestions of modern forest science, and the forest economy practised on the continent of Europe; instruction in the meteorological effects of forests on moisture on temperature, and on constituents of the atmosphere; in sylviculture, as applied in Belgium, &c., to utilize waste lands,—in the Landes of France, to arrest and utilize drift sands,—in the Alps, the Cevennes, and the Pyrenees, to prevent the disastrous effects and consequences of torrents,—on the Karst, in Illyria, to restore fertility to a land rendered sterile by the destruction of trees,—in the United States of America, to prevent anticipated evils,—in India, to secure desiderated good,—in Britain, to produce increased amenity, covert, and shelter; and instruction in the injurious effects of cattle, insects, and various diseases on trees.

Either in connection with economic botany, or in connection with forest economy, might be communicated information in regard to the preparation for sale of forest products, including the cutting up and transport of wood; in regard to the effects of pruning; and in regard to the collection of forest seeds, and the management of nurseries of forest trees.

Saturday might be reserved for field exercises and visits to woods, nurseries, museums, botanic gardens, saw-mills, and manufactories; and vacations might be spent in practical work under master foresters in various parts of the country, or in tours of observation in the

forests of England, of Scotland, of France, of Germany, or of the northern countries of Europe.

And one can scarcely conceive of a technical school not covering such a course of study would supply facilities for the prosecution of many accessory studies which might be made more or less subservient to the accomplishment of what is desiderated as a means of education for intending foresters.

Bark-stripping in Kent.

THE bark-stripping—or "flawing," as it is locally termed—being now finished throughout this county, and the produce safely in the hands of the merchants and tanners, the time has arrived when we may take a retrospective glance at the season, which has, on the whole, been an indifferent one for those employed. The promise of an early spring was followed by cold rains and winds and a succession of frosty nights, which checked the flow of sap and prolonged the work of the "flawers." Coppices had to be gone over a second, and, in some instances, a third time before a clearance could be effected. Except in some favoured situations, the cold and wet state of the ground caused the body-bark to peel badly even after the branches ran well, and hammering, so fatal to the quality of the produce, had to be resorted to. The custom of staging the bark for harvesting is very general here, and is found to be under all circumstances the most efficacious. Peeling by the ton is the usual method, and is certainly the best for all parties where a proper supervision is maintained. But in some instances we have this year come across unpeeled branches in sufficient numbers to have paid the entire cost of the operations. In settling up with different gangs of men, working upon the same estates, and under the same circumstances as to locality, size of timber, &c., we have found that man for man the earnings of some parties have ranged 25 per cent. above others.

The price of bark has varied according to quality and situation: £5 15s. in the woods has been about the average. We have paid 32s. per ton of 20 cwt. for stripping and stacking, 4s. 6d. per 100 for cutting up and tying oak-top faggots, and 3s. per cord for cutting up and stacking the wood. Good posts trimmed and turned out 6d. each, and spars 2d. each. The chips and "scramble," or small branches and dead wood, which the men are allowed to take for themselves, form a goodly and acceptable heap at the rear of many a cottage residence. A. J. B.

Transplanting of Large Trees.

By JAMES KAY, FORESTER, BUTE ESTATE, ROTHESAY.

HAVING transplanted a number of large plane (*Anglicé* sycamore trees during the last winter and spring months, a short account of our operations may be of interest to the readers of the *Journal of Forestry*. I may here state that I have been induced to give the following notice of our transplanting operations from what has appeared in the various journals lately, in regard to the planting of large plane trees, instead of young saplings, along the Boulevards in Paris, and likewise in the neighbourhood of London. It is a somewhat remarkable coincidence that the same operations should have been going on simultaneously in Paris and the Western Isles. It would appear, after all, that however necessary it may be for Scottish foresters to have their education and experiences finished on the Continent, they are, nevertheless, capable of performing work equal to their continental brethren!

The scene of our transplanting operations was along the side of the public road on the eastern shores of the Island of Bute, near Mount Stuart. We planted three dozen plane trees, averaging from twenty-five to thirty feet in height, with stems from six to ten inches in diameter. The trees were mostly taken from detached belts from two to five miles from where they are now planted. The number of trees to many may seem small, but when it is taken into consideration that the plantations here are mostly old (from 40 to 160 years), and that it is a difficult matter to get a number of trees of equal size and suitable for transplanting, they being either too much drawn or not well balanced, or in some awkward position for removal, it will be seen that the work of transplanting was not altogether of a light description.

The trees were removed to their new site with the machine for which I obtained an award from the Scottish Arboricultural Society in 1873. Part of the road along which the trees were taken having a steep incline, four and five horses were used in drawing the machine, while two, and, in some cases, three horses were sufficient for the remaining part of the journey. There being a traction engine on the island, we likewise gave it a trial, but, however effective it may be, it

can only be used on hard ground, or on roads with a good bottom, whereas horses can be used almost under any variety of circumstances. After a fair trial we discarded the engine, and used horses only.

It would be somewhat premature to say whether our operations are likely to be a complete success or not, but meantime the trees are making a favourable appearance and likely to be a successful piece of work. The N.E. gales which prevailed during the months of April and May scourged the early buds very much (not only our newly-transplanted trees, but likewise old-established ones), and certainly it detracts a little from the appearance of the trees. In the meantime, however, I find on examination of the blasted twigs, which are mostly on one side of the tree, that a host of young buds and leaves are making their appearance to take the place of those that have been destroyed by the late gales.

The transplanting of the trees already referred to is by no means the first of our operations in a similar way. In 1873 we transplanted thirty oaks, one lime, six large yews, one large laurel, two large thorns, and several pines, most of which were taken upwards of a mile. The trees have all done well and greatly improved in appearance since they were transplanted.

In 1875 we transplanted several large elms, from thirty to forty-five feet in height. Suitable trees were only to be found in situations difficult of access, and in several cases had to be taken along roads and through fields with an incline of one in two. Even after getting on to a public road our difficulties were not over, telegraph wires having to be disconnected to let us pass; but nevertheless, with all the difficulties, this has proved a most successful piece of work. The trees have all greatly improved.

Again last autumn (1876) the capabilities of our machine were once more put to the test in removing a large sweet bay under very unfavourable circumstances, on account of the time of the year (19th August) and the fastidious nature of the tree. However, there was no alternative; the site being required for building purposes, the tree must either be destroyed or removed. It was, therefore, decided to give it a fair trial. The tree and ball when removed was estimated to weigh about six tons, and was drawn to its new site, about a mile distant, by four horses and about thirty men. It greatly improved in appearance after being transplanted, making a considerable quantity of fresh growth during the latter end of the season, which, no doubt, may be accounted for from the favourable soil it was transplanted into, the original site of the tree being on a hard gravelly bottom.

Having reviewed our successes, I must also make known our failures. For some weeks past the sweet bay referred to has been

losing its fresh green appearance, and I have just made an examination of the tree, and I am sorry to say that it seems to be dead. I can scarcely account for this after having made so favourable an appearance during the late autumn and winter, unless it has been killed by the severe night of frost we had on the 27th of February last. I find on looking up our Meteorological Journal that 11° of frost were registered on that occasion, being double the next greatest amount of frost we had during 1876.

I may here remark that since we commenced transplanting operations with our machine (four years ago) we have transplanted 84 trees and large shrubs, averaging from twenty to forty-five feet high. The trees were in no way "*prepared*" previous to being transplanted, and we have only had two deaths—one laurel, and the sweet bay referred to.

I should like to know if any of the members of the Scottish Arboricultural Society have made use of the Transplanting Machine figured by me in the "Transactions" of the Society four years ago I should also like to know what kind of transplanting apparatus our continental brethren use, and with what success.

Perhaps at some future time I shall notify the results of our late transplanting operations, and possibly give an outline of the mode of using our machine under every variety of circumstances.

Abies Douglasii and its Precocity.

By JAMES GORDON, ROSSDHU ESTATE.

Of late years a good deal has been written and spoken in this and other countries about Coniferæ, and still our knowledge of them is far from perfect. The *Abies Douglasii* as a timber and ornamental tree cannot be said to have escaped notice. Some have spoken in admiration of its fine appearance, and others have enlarged on the quality of its wood, and have pictured to themselves the excellent returns from this tree that might be realized by proprietors and others were they and their foresters wise enough to plant plenty of it. The writer, too, has always been an admirer of this species of fir, but has never been led to think of it as a more *useful*, or even more *beautiful* tree than *Abies excelsa* or common spruce. Compared with *Abies excelsa* its habit is not so beautifully compact, its form not so sharply conical, nor its colour so decided. It is frankly admitted that when *Abies Douglasii* is planted side by side with *Abies excelsa*, in deep loam, it will grow faster and make more timber in a given time than the other, but this is no test of its comparative usefulness. The *A. excelsa* thrives as well in less favoured circumstances, in which *A. Douglasii* can hardly exist The soil and situation that suit *A. Douglasii* will invariably produce timber far more profitable than either it or *A. excelsa.* A well-grown specimen of *A. Douglasii* is certainly a noble tree, but it is difficult to imagine it becoming a profitable timber tree.

This *Abies Douglasii*, about which so much has been said, and said with all the energy of persons wishing to annihilate an old, worn-out, and establish a new sound *arboricultural system*, seems to have a propensity to early flowering, of which the writer, until this season, was unaware. A number of specimens were lifted and replanted in the nursery here in the spring of 1876, with a view to removing the plants to permanent situations during the spring of this year. This replanting and transplanting has caused them to develop numerous male and female flowers, although the plants are not more than six feet high on an average. On examination I found the flowers to be protandrous, and consequently impregnation was hopeless, unless by impregnation of the earliest female flowers with the pollen of the latest males, which latter were perfect about the beginning of May, and not a few of them earlier. Three cones were thus treated, but

with what success it were premature to say. The majority of the female cones are, from the cold winds of April and May, and probably also the imperfect action of the pollen on the stigmas, imperfectly developed.

It may not be out of place here to state a peculiarity in the case of pine and fir inflorescences which may or may not have occurred to some of your readers. In the case of the genus *Pinus*, a male *flower*, or rather inflorescence, is simply a *leaf* modified to serve the purposes of reproduction. In the case of the genera *Abies*, *Picea*, *Cupressus*, &c., the male inflorescences are *branches* modified to serve the same purposes. Hence we find that plants of the latter genera flower much earlier in the season than those of the genus *Pinus*, seeing that branch buds are formed in the autumn of the preceding year. It may also be stated that female cones of *Abies Douglasii* take an ascending direction on their first appearance, but after impregnation has taken place they then assume a pendulous position. The purpose served by this peculiarity is easily understood; but will some one of your scientific readers kindly inform the less favoured among us *how this change of position is effected?*

Poets and their Favourite Trees.

ALEXANDER POPE, in one of his extra-poetical moods, once said: "I consider a tree to be a more splendid object than a prince in his coronation robes." Who can doubt the propriety of Pope's remark? Whether we look with admiration on—

"The poplar, that with silver lines his leaf,"

or sit where the sparkle of the sunbeams may be seen glancing upon the leaves of the—

"Sycamore, capricious in attire;
Now green, now tawny, and ere autumn yet
Have changed the woods, in scarlet honours bright;

whether we wander beneath the shadow of the radiant green of the loosely hanging foliage of "the vine-prop elm," while the masses of light which fall through its branches chequer the pathway; or take our stroll in the forest alley where—

"The grey smooth trunks
Of ash, or lime, or beech, distinctly shine
Within the twilight of their distant shades,

do we not feel the poetry of the forest pressing itself upon our minds? There are the varieties, the brilliancies, and the suggestions of the renewed foliage to call forth our admiration; and there are the delicious odours, coolness, and shade of the forest trees to excite our thankfulness and delight. And if it be that we can roam where—

"The rough forester,
Whose peeled and withered trunk and gnarled boughs
Have stood the rage of many a winter's blast,"

how many themes of solemn thought arise concerning the present and the past, even while we rejoicing remember in our woodland ramble that—

"Hence the poor are clothed, the hungry fed,
Health to himself, and to his children bread
The labourer bears"!

How many associations swell the breast regarding—

"The lover's myrtle and the poet's bay"!

And then, when the country stroll is done, or the indoor chair has

been taken instead of the outdoor seat, what tranquil pleasure remains in the heart from the memory of trees!

Forestry and poetry have always been nearly allied. Poets have always loved and often sung of the woodland, and made the sylvan scene—

"Live in description and look green in song."

In the olden days, when the angels appeared to Abraham at Mamre their visit sanctified the oak tree under which they sat as the guests of the patriarch, and gave it a glory in the eyes of the wandering Arab which led him to make it a shrine of pilgrimage. It has, though in a less degree, somewhat similar with the poets of our land and the trees in which they delight. Memory lingers round them with pleasure and pilgrimages are not unfrequently made to those places where the poet's favourites are to be seen or even fancied. The Persian poet Hafiz, is buried under a cypress of his own planting, whose leaves give gratification to the Oriental mind, while its branches overshadow the last resting-place of the child of song. A lime tree overhangs the grave of Klopstock, the Milton of Germany; and in the garden of St. Onifroi's convent, on the Janiculum hill, the oak under which the dying Tasso lay is still shown.

Chaucer, our morning star of song, dwelt at Woodstock, and whil there,—

"With a lodge out of the way,
Beside a well in the forest,"

composed many of his poems. Another place which has acquired fame from its connection with Chaucer is Donnington Castle, Berkshire. Evelyn tells us that there was an oak in the park at Donnington which tradition asserted to have been planted by Chaucer, and which was still called Chaucer's oak. The cedars at Wilton, under which Sir Philip Sydney's "Arcadia" was written, are genuine descendants from the sacred trees of Lebanon, and may not have been effectless in connecting that flower of chivalry with those associations of holiness and wisdom which they suggest. The rural village of Hurstwood, near Burnley, in Lancashire, with its fine forest scenery, was the place most probably in which Spenser earliest learnt to chant his lays of love and fairy lore, and felt the force of youthful affection. Everybody has heard of the mulberry tree, which Shakespeare planted before New Place, in Stratford-upon-Avon, under whose branches Drayton and Jonson tasted his gentlemanly hospitality shortly before his early death; and the tale of its being cut down and manufactureo into innumerable curiosities has excited the ill-feeling of many against the perpetrator of that sacrilegious act of destruction.

Not to speak of the mulberry trees in the garden of Christ Church

College, Cambridge, associated with the name of Milton, we may yet remind our readers of the rural interval he spent in Horton, where he points out to us that his father's—

> "Cottage chimney smokes
> From between two aged oaks."

Is there not a fine affectionateness in his remembrances of the old wooded scenery of Buckinghamshire, where he says in "Comus,"—

> "I knew each lane, and every alley green,
> Dingle or bushy dell of this wild wood;
> And every bosky bourne from side to side,
> My daily walks and ancient neighbourhood?"

He was always fond of trees, and had them growing, as it was then possible to have them, beside all his London houses.

Crawley, an earnest lover of nature, enjoyed the garden and forest retirements of Chertsey, as any one may see who reads his *Garden*, and specially looked with love on a live tree which on these grounds "spargit odoratam lete et equaliter umbrum." Glorious John Dryden when he resided in No. 43, Gerard-street, the fifth house on the left hand, entering from Little Newport-street, had the windows of his study looking into the gardens of Leicester House, and delighted to see them. There is an embowered alley at Rushton, in Northamptonshire, which still bears the name of Dryden's Walk; Chesterton, in Huntingdonshire, is also associated with Dryden as well as Charlton in Wiltshire, in all of which he rejoiced in the woodland scenery they spread before him. A willow for which Dr. Samuel Johnson cherished a special love, and which he visited whenever he returned to his native town stood between Lichfield Cathedral and the Vale of Stowe. It is described and an engraving of it given in the *Gentleman's Mdgazine*, June, 1785. It was shaped, it is stated, in Shaw's Staffordshire, into vases and other memorials. While speaking of Lichfield, we may mention that near it Dr. Erasmus Darwin had his Botanic Garden, which contained many good specimens of remarkable trees on which he expended loving care. A cork tree was his peculiar favourite, but that his pen lost sight of. Coleridge, while living at a lonely farm house between Porlock and Linton in Devonshire, dreamed his entrancing vision of the garden of Kutla Khan,—

> "Where blossomed May on incense-bearing tree,
> And here were forests ancient to the hills,
> Enfolding sunny spots of greenery."

The Yardley Oak of Cowper, which grew close by the site of the chief carriage-drive round Yardley Chase, near which is the seat of the Marquis of Northampton, Castle Ashby, is endeared to all lovers of

poetry and forestry; not only for its grotesque figure and great size but for the interest felt in the poet of "The Task."

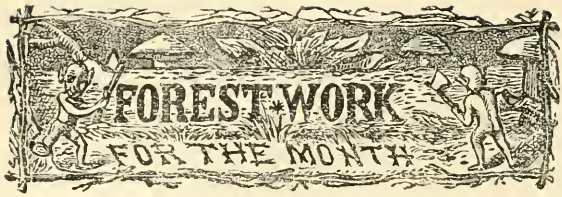
"England," said Hugh Miller, "has produced many greater poets than Shenstone, but she never produced a greater landscape gardener." "Leasowes" is Shenstone's best and noblest woodland poem.

Samuel Rogers saw at Dalton a lime 130 feet high at Lord Montague's country seat and never forgot the time,—

> "When the sweet lime so full of bees in June
> Led us to meet beneath its boughs at noon."

Wordsworth's hearty love for trees is well known; Scott was almost an idolater of woodlands; Tennyson's delight in forest scenery is written in many pages of his pleasing poems. Did space permit we might extend these cursory notes to almost any length; but we shall at present draw to a close by quoting a few passages from an epistle addressed in 1711 to Jacob Bobert, author of "The Effects of Great Forests on Trees and Plants, &c," Professor of Botany at Oxford.

> "Show us the trees by nature spread
> To form the coolest noontide shade;
> When our first ancestors were seen
> Outstretched upon the grassy green.
> * * * * *
> Teach us, thou kind judicious sage,
> The manners of a wiser age.
> To thee was given by Jove to keep
> Those grottoes where the Muses sleep;
> To plant the forests where they sing,
> Fast by the cool Castalian spring;
> With myrtles their fair lions raise,
> Soft, intermixed with Delian bays;
> And when they wake at earliest day,
> To strew with sweetest flowers their way.
> * * * * *
> Till soft Favonius, from the flowers
> Breathes balmy dews, drops fruitful showers,
> And with the gentle twins at play
> Brings in the Elysian month of May."



GENERAL REMARKS.

Look frequently over young plantations, and see that all is going on satisfactorily, and the plants are not being choked with ferns, whins, broom, brambles, or other rank vegetation, which ought always to be cut down before they are likely to interfere with the health of the plants.

Trees that have been planted a few years ought now to be looked over, and all shoots competing with the leader should be shortened or removed with a pruning knife, so as to direct the sap into the main stem to form a strong and vigorous leader; and with that view all other gross shoots throughout the tree ought to be regulated with the knife, taking care to avoid reducing the foliage too much at any single pruning season, else the tree may suffer in health from want of leaves to elaborate the sap. Tree-pruning of any kind ought always to be performed with great circumspection, and by an experienced person, who has a full knowledge of the object desired to be attained.

When other work gets slack, no opportunity should be lost in clearing, draining, and fencing land which is intended to be planted during the ensuing season. Such work is too often neglected until there is not time left to perform it in a satisfactory manner, and by getting it done at this season of the year, when the days are long and the weather dry and favourable, it can be executed in the best manner for the ultimate success of the plantations, and at much less cost.

Pay every attention to keeping the nursery clear of weeds at this season, as many of them run to seed in a few days when the weather is hot and dry, and give no end of trouble to get rid of them again.

Weeds cut down by the hoe in a young and tender state immediately disappear under the scorching rays of the sun, but if they have been allowed to get to the flowering state, they must be collected and carried off the ground as soon as they are cut, to prevent them maturing and shedding seeds, which many of them will do if allowed to remain on the ground where they have been laid by the hoe. It is bad economy to let weeds get to such a size, and in

nothing else that we know of is the old saying more true than "a stitch in time saves nine."

Look over and see that no spring-planted trees are suffering for want of water, and the ties of grafts should be examined and taken off where the union of the stock and scion is complete, and at the same time all growths or suckers from the stock should be clean rubbed off, and be careful to see that the graft is secure from being damaged by the wind.

About the end of the month is generally the best season for budding trees, as the young bark then rises freely, and is in the best state for manipulating, and the buds "take" quickly while the sap is still in full flow. In about ten days or a fortnight after the operation has been performed, the ties which secure the buds should be slackened and re-tied, as they are liable to become too tight and injure both stock and bud. If the stock is vigorous and growing freely, the bud will have "taken" in about a month after it is put on, when the ties ought to be entirely removed.

ENGLAND.

We regret that the special remarks on the work for the month in England have not come to hand in time for insertion in this number.

SCOTLAND.

From all parts of Scotland we have received the most favourable accounts of the oak peeling operations carried on during the last two months, the dry, warm weather being everything that could be desired. From Scotland we learn that the bark season has been very short, owing to the late spring and the extraordinarily rapid growth of the trees, and consequent rapid elaboration of the sap, caused by the great heat of the sun in an almost unclouded sky. The peeling season being now virtually over, the drying and securing of the bark should be carefully attended to, and no effort should be spared in turning and exposing it to the sun, and getting it either stacked or carted off to the tanner when properly dried.

Those foresters who have charcoal to make should now begin to do so, as the men are all the better for the long daylight while watching the kilns during the night. This duty will also necessitate the carting in of a quantity of peeled oak for charring purposes, and it is of much importance to the men in charge of the work to have the wood laid down to them in proper order. There should at least be three different sizes for an ordinary kiln, and when these are kept separate

in the yard much time and labour are saved, as the men can put their hands at once on the size of wood they require. In some places, both in England and Scotland, the kilns are thatched over with straw and sand, but if it is possible at all to obtain it we would very strongly recommend turf as a substitute for this purpose. A single trial of it will show that there is a great saving of charcoal by its use. When sandis used, it is constantly finding its way down amongst the wood; and as a result of that the charring process is not fully completed; for when the kiln is put out and the charcoal is being measured up, large quantities of wood are found in a half-charred state, which have to be kept back and done over again in the next kiln. Our readers will have seen that this subject is to be discussed at the annual meeting of the Scottish Arboricultural Society in November next, and we trust that it will then receive that attention its importance deserves.

Advantage should be taken of the dry weather this month to get all the oak trees carted to the saw-mill, or wherever their destination may be, as they have often to be dragged a considerable distance before being laid on the cart, and if it is done in wet, slushy weather the trees get all pasted over with gritty mud, which tells most disastrously upon the saws, when the trees are being planked. If the carting is done immediately, weather permitting, it also lightens horse labour, as the drives throughout the plantations are firm, and can stand a very great amount of traffic without being cut up. It is quite certain that nothing puts a horse out of condition quicker than the jolting of a wood-cart on a heavy road, and the price of these animals just now is a consideration not to be overlooked. Those hedges at the side of plantations that are not cleaned with the spade should now be gone over, and all grass and nettles should be cleaned away from their roots with a hook, as the growth of these prevents the hedges thickening, and the decayed straw is a great hindrance to the workmen when trimming them in the winter months.

Pruning or switching hedges at this season is very beneficial to those that are apt to become bare and open at the bottom, the upper half of which should be switched with the knife at least twice during the summer, early in July, and again in August, which will induce a young growth from the bottom, and along with the lower half of the hedge it ought not to be cut in till the winter trimming. It is scarcely necessary to add that weeds must never be allowed to overrun and smother the growth in thin-bottomed hedges. Those ornamental hedges that are cut twice in the year should receive their summer trimming early this month, as it enables them to push forward and ripen a second growth before the autumn frosts set in. If there is a great amount of this work to be done, the switching knife may be used to advantage,

and will make very clean and smooth work if skilfully handled. On box and privet hedges, however, it will be necessary to use the shears, as they have not stability enough to resist the stroke of the knife: Foresters would do well to keep an eye on the thistles which spring up so luxuriantly on the borders of plantations, and have them dug up by the root before they flower, as the seeds of these plants not only travel far, but are also sure to lodge themselves where they are not wanted. The same remarks apply to all other strong growing weeds, docks, nettles, and such like nuisances in plantations.

IRELAND.

This is a good time for repairing roads and bridges in the plantations, and making new ones where required. Having finished peeling operations, the small branches should be gathered into heaps, seeing particularly that all open drains are clear, much damage being often done to bridges and roads by neglecting to look after the drains before the heavy autumn floods set in.

Grass, ferns, and furze should now be mowed from among young trees without delay; never allow grass to grow too long, or it will lop with the rain, and destroy small plants.

In Ireland, where almost every forest is chocked with ivy, the warm weather of July ought to be taken advantage of, cutting it off around the butts of the trees.

Ground intended for planting ought to be drained this month, if not done before, to allow the ground to "drip." Now is the time to look after the fences, the fly will make cattle leap over anything, and when once they find a way into a wood it is difficult to keep them out.

Evergreen hedges should now be switched or clipped; we prefer the knife to the shears; keep young hedges clear from weeds.

Towards the end of the month is a good time for laying hollies, by cutting the roots on one side and pulling the tree over. This is done to increase and extend game coverts. Loppings of laurel inserted into small trenches, and firmly covered with earth or soil, will strike root, and make excellent cover next year, if done this month. From the middle of the month budding should be done. We use a kind of wax at this work, which has proved very successful. One part of tallow, one part of beeswax, and four parts of rosin melted together, and when properly mixed applied hot over the matting. We do not use bass, but only soft jute thread for tying when budding.

In the nursery all weeds ought to be pulled, and the ground kept clean. Carry all rubbish away at once, for weeds, though cut, will produce seed now. Keep all seed beds clean. Larch are breaking

the ground, and cannot be too well attended to if a fine regular briard is desired. Gather and sow elm seed, if not already done. The end of May, or first of June, is the proper time to sow elm in Ireland, but they will grow if sown now.

WALES.

All our bark has now been delivered, and having been sold early, has been delivered from the ranges, and in very good condition.

On the whole the flow of the sap has been bad, but if the season has been a bad peeling one, it has been a good drying one, and I think most bark has been well secured in this district. We are just finishing dressing the oak timber, after being peeled, but which in some places will not be finished for a week or two.

Pruning hardwood trees should be finished as early as possible, which is only done slightly, by shortening lower and straggling branches at a joint, and where necessary removing others which have been previously shortened. Where not already done, look over young plantations, and clear gorse, grass, and other herbage from the young trees, which if done now is not likely to grow again so much as to injure the plants this season, but will afford them a little protection during the winter.

Clean hedges, by keeping them free from grass and weeds, and stirring the soil on the surface, growth is promoted, and the plants receive the full benefit of every shower. When young hedges are neglected, and not kept clean, they soon become open in the bottom.

Repairs wire and rail fences, as cattle are very restless during the hot weather we have been having. Now is a good time to tar wire and iron fencing, while the weather is warm and dry.

Hoeing and weeding in the nursery grounds, if done early, check seeding, save much labour, and give the plants the benefit of a free circulation of air.

Mowing and cleaning in pleasure grounds, and keeping walks and carriage drives clean, and pinching and pruning trimmed laurels and beds of choice plants in the shrubberies should now be attended to.

Evergreens lately transplanted require plenty of water during dry and warm weather.

A GOOD SUGGESTION.

Sir,—I have perused with much interest the two numbers of your excellent journal which have appeared, and it has occurred to me, if you will allow me to make a suggestion, that your laudable endeavours to raise the status of forestry, and to promote the welfare of the numerous and deserving body of foresters, would be immensely assisted were the landowners of the country to take some interest in your journal and to furnish one or more copies for the use of the young foresters on their estates in their bothies or cottages. The price of the journal, considering the amount of letterpress and valuable matter it contains, is not by any means extravagant—indeed, it appears to me very moderately charged,—but still 12s. a year is a consideration to a young forester, and may deter many a one from having access to the pleasure and profit which the perusal of the journal would give him. In the interests, therefore, of the assistant foresters I make this suggestion, and trust that the landlords of the country will in this way aid you in furthering the welfare of their workmen, while they will at the same time be conferring an advantage on themselves by affording their labourers the means of elevating themselves and their work from mere routine duties to an intelligent and popularly scientific treatment of the work committed to their charge.

Hoping that many of my fellow-landowners will avail themselves of this suggestion, upon which I have myself acted with advantage, I am sir,

A Scotch Laird.

THE MODES OF MEASURING TIMBER.

Sir,—In reference to Mr. Barry's article in the last number of the *Journal of Forestry*, on measuring round timber by the quarter girth method not being mathematically accurate, I cannot help thinking the objections to the method are not quite valid; mathematical accuracy is not aimed at, but simply a commercial approximate value is sought for, by the readiest methods which shall be fair to buyer and seller, allowing for contingencies of defects, waste, &c. The system of tare and tret is carried out in all wholesale trade measurements and reckonings, whether in bark

hides, faggots, hay, eggs, milk, sawing, down to the baker's dozen of rolls.

For practical purposes the slide rule will show at once the difference in the contents of a tree by quarter girth method, and the exact mathematical measure, or, as it is commonly done, by multiplying the square of one-fifth of the mean girth by double the length, and the product will be nearly accurate as to the solid contents of the tree ; but no tree would ever plank out to the contents stated thus mathematically.

Having had to buy and sell timber largely, both in round and plank, I have found the rough and ready method of girthing with a piece of string and doubling four times, though it gave the buyer an advantage of a quarter more timber than was charged for, was an economy of time in reckoning a large number of trees in a day's measurement, and the price per foot was always augmented accordingly.

Of the real practical difference between a tree measured by quarter girth method and the contents of the planks it is cut into, I find the gain to the buyer averages one-eighth more. From many opportunities of testing measurements I select the following, which I noted particularly :—

It was a very clean grown ash tree, and measured 102 cubic feet by the quarter girth method, but 128 cubic feet when measured accurately as a cylinder. It was cut into the usual sized planks for coachmakers' and wheelwrights' purposes ; the sawing wasted $2\frac{1}{2}$ cubic feet. The slabs measured 9 feet, and sold for about 12s. The planks measured $116\frac{1}{2}$ feet cubic measure. The sawdust was useless on farms till succarized by diluted sulphuric acid for mangold wurzel land ; so that the buyer, when the tree was planked, had $14\frac{1}{2}$ feet more than he paid for in the round. When the planks were sold the original critical measure for testing the difference of cubical contents would not hold out. Allowances for shrinking, flaws, and bevelled edges of planks certainly reduced the selling measure of the planks $1\frac{1}{2}$ cubic foot. Other samples of trees have been so ungainly, and opened so badly, that they barely planked up to the round measure. I may here note that by sawyers' measure the usage is to charge a double cut for the first cut, this is to say for the trouble of dressing up the log, "pitting," and cutting to the owner's advantage : and though the saw-cut may be under six inches, less than that is never reckoned in plank sawing. As a tape is used for length as well as for girth, the proposal to alter the 4 in. spaces might lead to confusion.

JOHN CHARLES KING.

WOOD MEASURING.

SIR,—In No. 2, of the *Journal of Forestry*, we have an article on the above subject in which the writer says "that on paper, at any rate, sellers of timber are deprived of a percentage of their property from the inaccurate system of measurement." I cannot see how this can be made out, and consider that "the simplicity of estimating the contents of a tree by the

quarter-girth principle *is* an ample excuse for its use." We know that the true solid content is not obtained by our present method, but so long as it is the generally accepted system the seller knowingly gives a certain quantity of wood to the buyer for a certain sum of money, and the buyer is aware that he is getting an inch or two more than the exact foot, and squares his price accordingly; so that in the end there is no loss to the grower o the wood. It is a fact that if one forester measures his wood making an allowance for bark, which I believe is the Scotch system, that man will get per foot a higher price than another can who measures his trees without the above allowance. It would be a great advantage to the trade generally to adopt one system of measurement throughout Britain, and that to measure including the bark. Peeled wood might then be valued a little higher per foot. Mr. Barry's example, as showing the difference of the real from the false measurement of a tree, is nevertheless rather striking, and is worthy of all consideration from those interested in the sale of wood. The thickness of bark varies on one tree from another, and more especially on one kind of tree from another, so that the price per foot of any particular kind of wood would be regulated by the bark. All who use the tape or girth-line know that it is very difficult to make a true allowance for bark and consequently a tree is more often sold *as a tree* than by so much per foot; yet it is customary to use the rule and line so as to form a near estimate of the solid contents. The fact, as noticed by Mr. Barry, that a tree measures more by one-sixth when cut into three pieces, or measured at three places, should never be lost sight of by the forester when selling wood at so much per cubic foot. M. R

SCHOOL OF FORESTRY.

Sir,—I find that several of my correspondents are desirous that irrespective of what may be done, or may not be done, to secure the creation of a School of Forestry in connection with the projected Arboretum in Edinburgh, the first School of Forestry established among the English speaking populations of the world should be in England. Very good! I have no objection.

From an excerpt from the *City Press* of the 9th current, which I have received to-day, it appears that a meeting to initiate a national scheme of technical education was held at Mercers' Hall on this day week which was attended by representatives of the Corporation of London and of several of the London Companies, at which it was reported that the Mercers' Drapers', Fishmongers', Goldsmiths', and Clothworkers' Companies had each conditionally promised an annual contribution of £2,000 towards the project, provided, of course, that it took such a shape in its development as they could approve, and support was promised conditionally by the Armourers and Braziers', the Plasterers', the Vintners', the Ironmongers', the Salters', and the Dyers' Companies, and approval was expressed by the

Painters', Coopers', Shipwrights', Weavers', Loriners', Spectacle-makers', and Glass-sellers' Companies; and that a committee was appointed to prepare a scheme in furtherance of the object of the meeting.

The reporter adds, "It may now be said that the Corporation and the companies have set themselves to work in earnest in the cause of technical education, and thus united they can hardly fail of success."

With so many of the companies directly interested in the timber trade why might not instruction in the forest science of the day, and its application to the management of woods and forests, be included in the arrangements to be made?

I send with this a statement of the arrangements made in the Polytechnic School at Carlsruhe for the study of forest science and of forest economy, which will show the practicability of including provision for the study of forestry in a broad scheme for technical education.

It will also show, which may be of use otherwise, how broad and comprehensive is the instruction deemed requisite for foresters on the continent of Europe compared with what is given to foresters generally in England.

As to the honour which may attach to priority in founding a School of Forestry in Britain, *Palmam qui meruit ferat.*

JOHN C. BROWN.

Haddington, 14*th June*, 1877.

THE POPLARS OF CLAPHAM COMMON.

SIR,—I am not going to imitate those ingenious correspondents who begin their communications to you by eulogising your undertaking and the spirit in which you have put it before us. If I limit myself to stating that I am ready to endorse all they have said in its favour, you will, I dare say, be as well pleased as if I had gone a more roundabout way to show my good manners. No doubt you have better evidences than polite phraseology that your work will succeed; and "words butter no parsnips," as I learned many years ago from the sage admonitions of my honoured grandmother.

At page 118 of your last number—for I like to be circumstantial—are some sensible "general remarks," very modestly offered by Mr. William Mainwaring, of Brimfield, who, while renouncing in graceful language all pretension to figures of speech, puts before us some very important arithmetical figures, that seem to me so large of their kind that I take the liberty of calling your attention to them. He tells us where he saw in 1868 "some remarkably fine specimens" of the abele poplar, and I am sorry that it was not of his own knowledge, but only from information received, that he gives us the cubical contents of five other trees of the same description "that had been blown down some time previously"—apparently on the same property.

What impresses me as singular about it is that the great size of these

trees seems to be nothing uncommon in that neighbourhood, nor to call for any special observation, though the smallest of the five contained *eleven loads of timber,* and all the others *over thirteen loads each.*

Now these would be counted large trees in any country, and they are by no means common sizes in our own ; and how such a cluster of them got together to be blown down, apparently so nearly of an age and dimensions, one would really very much like to know. Also is there any record to be found in the chronicles of the Longleat Estate (which I cannot find in my *Gazetteer*) of the period at which these windfalls were planted ? There are other questions, if it were not impertinent, one would like to ask. Was the timber sold ? and if so, what price did it fetch ? Or was it used on the estate, and for what purposes ?

In the same number of your journal a writer, who calls himself "An Amateur," expresses some curiosity about a good-sized poplar tree (of a specified age), stated in your first number to have been recently felled at Linlithgow, and which seems to have fetched a good bit of money. But this, though containing eighty feet of timber, was a mere sapling in comparison with those overthrown giants of the forest mentioned by Mr. Mainwaring. If the wood of the abele is so valuable, and if, as he states, it grows as fast as the black Italian poplar, it would almost appear that an important item of our national wealth has been heretofore very much overlooked. But as the writer of "General Remarks" calls upon Mr. Berry, of Horningsham, by name "to give us some interesting particulars on this subject," it is to be hoped that we shall soon learn from good authority all about the poplar tree, and to what uses its wood may be advantageously converted.

You invite contributions, Mr. Editor, and the interchange of arborical information, through the medium of your columns, and as several writers have made special allusion to the poplar tree inquisitively, in the portion of your work already before us, they will not perhaps think me presumptuous if, while I have my pen in my hand, I direct their attention to where practical knowledge on the subject may be obtained, if I have nothing myself worthy their consideration to offer. The study of trees is limited to no place or class of people, and a denizen of the city, who is a lover of the woods, may exchange ideas with a far-off ranger of the wilderness, to the profit of both. Everywhere lessons may be learned in it, and Clapham Common offers to the investigating forester as good a field of research perhaps, as the Trossachs.

Some years ago there were many large trees of the poplar species on that much frequented pleasure ground of Southern London ; but the infirmities of old age gradually weakening their powers of resistance to the elements, and their stupendous limbs, like mighty elephants' trunks, thrown far up into the sky, becoming at last an intolerable burden, they have been picked off by successive gales of wind, till few of any remarkable magnitude now remain there.

One fine old specimen, however, of, I think, the black kind (*P. nigra*) stands almost at the entrance of the common from the London side, and

if you follow the pavement along from "The Plough," where the cars and omnibuses stop, before you have gone a hundred yards you will see it straight before you, in the centre of the main walk, which it divides into two of lesser width. It is environed with a wooden bench and back-frame, as a resting-place for pedestrian visitors, which may afford comfortable sitting room for perhaps twenty people at a time, and it is much resorted to for shade, repose, or shelter by the wayfarers who loiter near. This tree appears to be still in a good sound state, though heavily carbuncled about its base, where it is, perhaps, over twenty feet in circumference, with its deep channelled bark, like tangled cables, and possibly, if its massive branches be taken into account, the whole fabric may contain six or seven loads of timber, but not more, I imagine, roughly estimating it as a passer-by.

There are also several fine sound abeles of a good size round about, such as those westward of the church (which is seen in a quadrangle, chiefly of noble elms) a little farther along. These are all crippled aloft, but bear themselves grandly in their fallen estate, and the humiliation of being ap-*prop*-riated (literally) by the laundresses of the neighbourhood, who use them as colossal clothes props; and we contemplate them with that sort of feeling which inspires us when we see a venerable castellated ruin taken possession of by an unappreciating shepherd as a pen for his flock.

On the east side of the *Long pond*, which is away to the left, are two good sound trees of this kind still in healthy and undamaged growth, perhaps nine or ten feet in circumference, at a height of fifteen or twenty feet from the ground. In short, the arboriculturist, not too remote, who desires to enlarge his knowledge of the poplar tribe—and many other forest trees as well—may spend a few contemplative hours on Clapham Common with considerable advantage, as he will find there many varieties in all stages of growth, vigour, and decay.

Two old trees of the Lombardy species towards the Balham end of the common, and not far apart, afford in themselves a curious study. Both are broken short off, at some twenty feet or more from the ground and in this state their trunks have rotted *within* while putting forth vigorous branches from *without*, and these have again shot up skywards, to the height and size of stalwart young trees, like prodigals determined to enjoy the present hour, whatever becomes of their poor old parent, whom they are starving. Neither of these wrecks, which may girth fourteen or fifteen feet, has any pretension to the circular in form at the base. They seem to have thrown out natural buttresses below, in order the better to resist the elements above; and on this account, perhaps, when oppressed with their top-weight, the wind might break them off, but could not overturn them.

In your first number it is stated that the black Italian poplar was originally brought into this country in 1772, the Lombardy perhaps a trifle earlier. Therefore, if that date be correct, these *accidental pollards*, which are of that species, could not be more than about a hundred years old, no great age for a large tree to exhibit itself in the last stage of existence. Possibly their decrepitude may have been

accelerated by being violently rent across in a jagged manner years ago and the heart of the wood ever since exposed thereby to the action of the weather. But their state is suggestive of questions as to the time this kind of tree takes to arrive at maturity, the duration of its robust health, and how long it is withering away to its final collapse; all of which will, we hope, be brought to light in your pages by experienced foresters, just as the ephemeris of a new planet is settled, and its period determined, by comparing the observations of different astronomers.

My letter has run to a much greater length than I intended. Perhaps, sir, I ought to have waited till the inquiries of "An Amateur" and those of Mr. Mainwaring had been answered, which might render some of my own unnecessary. But, after all, if I have communicated anything useful and not unentertaining to your readers, they will scarcely complain of the space occupied by a well-wisher to your enterprise, and

A Desultory Forester.

THE CULLEN PRICES.

Sir,—I hope, though late, I am yet in time for your next issue of the *Journal of Forestry*, and that you will kindly spare a corner for a few words of reply to your correspondent who designates himself a "friendly critic," and signs "Ancora Imparo," page 117. But for the introductory announcement that the criticism is friendly, it might have been understood otherwise; and but for the concluding, sealing sentence, that he is anchored fast, and all secure, it might have been concluded that his moorings had given way, and that he was terror-seized and panic-struck at the high prices paid for timber at and near Port Cullen.

As I am responsible for the quotations referred to, I feel in duty bound to put things right to the full extent that I have deranged and put them wrong. The prices quoted, I have to repeat, are those paid for timber at and near Cullen for several years past, and such as are paid to-day, both by private sales and at auction. By the former the prices are fixed and steady, while at the latter they rise and fall, sometimes above and sometimes below the prices quoted.

I shall be very glad to furnish your correspondent with the names and addresses of the purchasers of the timber, at the rates quoted, on receiving his address *bona fide*; and whether his surprise be thereby appeased or not he will at least find proof that the prices are not only for past years, but for the past month, even so as I have quoted them.

It is to be regretted that your correspondent when in Banff did not come the way of Cullen, where he could have obtained the information sought. I think some of your critic's other remarks might be liable to criticism by those who have the will to do so, such, for example, as his definition of a *forest*. I always understood that a forest was a mass of broadlands, greater in extent than a group or plantation; but when

he speaks of farmers planting forests upon their farms, my notions there upon became fairly *non-plussed.*

C. Y. Michie,

Cullen House, Cullen, June 23rd, 1877. Forester.

Sir,—The writer is much pleased to see that there is now set a-going a medium through which the forester and all interested in the growing, buying, and selling of home-grown timber, can air their ideas, affording them the means of directly placing before the class in whom they are most deeply interested, any information they may think would be beneficial to those following the same vocation as themselves, and of gaining information from articles contributed by others.

I most heartily wish your journal a long and prosperous career. In order to ensure its success, however, reports appearing in its columns must be as accurate as possible, otherwise it will defeat the very object which it is established to promote. Your contributors must send correct statements regarding sales and prices obtained at them throughout the country, else their contributions may do a considerable amount of harm amongst the class they are meant to benefit.

In your first number I was much astonished to see the very high prices obtained for home-grown timber at Cullen (Banffshire), and along with your friendly critic "*Ancora Imparo,*" I think that surely some mistake has been made, and look forward to see matters set right in your next issue.

The prices given at above place are higher than I can get for timber. I am situated within five miles of Glasgow, and one would very naturally imagine that we should be able to get as good prices here as could be got anywhere throughout the country for home-grown timber.

During the last two years we have sold over £2,000 worth of timber, the greater part of it oak, mostly suitable for ship building and waggon making purposes, and we never have been able to get within 1s. 6d. per foot of the price reported from Cullen.

At our last sale in end of March the prices realized for timber were as follows: Oak, 2s. 10d. per foot; ash, 2s. 6d. to 3s. per foot; elm, 2s. 6d. per foot. Beech, suitable for plane makers, 1s. 6d. to 1s. 10d. per foot; plane tree (large size suitable for printworks, &c.), 4s. to 4s. 6d. per foot; (small size suitable for turners), 2s. to 2s. 6d. per foot; birch 20s. per ton weight; willow, 1s. 2d. per foot; poplar, 2s. per foot; Scots fir, 1s. 2d. per foot; larch, 1s. 6d. to 1s. 8d. per foot.

By giving this a place in your July number, you will oblige

Ranger.

———

BLACK ITALIAN POPLAR.

SIR,—Your correspondent, "An Amateur," from "near Old Oak Farm, Middlesex" (see page 112 of your last number), seems hardly to believe in the authenticity of the statement I made in your first number in regard to the value of the black Italian poplar, and expresses a wish for further information about such a valuable "stick," especially the purposes for which it is chiefly used. I will try to enlighten his ignorance, and satisfy his curiosity, so far as to state that I have made inquiry of the merchant who bought most of the black Italian poplar at our sales, and he writes to say that it is used by carriage builders, cartwrights, railway companies, and others for a variety of purposes where *toughness* or *resistance to friction*, combined with comparative *lightness*, is a necessary requisite in the timber used; such as linings for the bottom and sides of waggons, carts, and barrows, the blocks of railway breaks, &c.; and we have ourselves used it for flooring and for fencing rails, and other estate purposes, with much advantage.

Your correspondent seems surprised to see the black Italian poplar classed with hardwood, but that was done, not so much for its hardness of quality as to distinguish it from *fir*, in which sense I have no doubt most of your readers will have understood the statement. Perhaps "An Amateur" will plead "ignorance" when he speaks of a "species of poplar" being known to commerce as "hacmetac!" He appears to be as ignorant about "commerce" as he is about "poplars," else he can hardly have looked into any nurseryman's price list of forest trees without observing a "species of poplar," *P. balsamifera*, named Tacamahac; but certainly it has never been "much esteemed," either here or in America, "in shipbuilding."

Again, he states that instead of 70 trees 700 at least might be grown upon an English acre, but 70 full-sized trees are quite enough for our purpose; and any one who expects to grow them to be worth £5 to £6 each will find the number I stated quite sufficient to fully occupy that space.

Seventy of such poplars I measured yesterday, some of which, at six feet above ground, measured more than thirty inches in diameter, and contained upwards of 100 cubic feet of timber.

In sending to the journal the short notice of the prices realized, and the position taken by the black Italian poplar at our last sale, I did so for the purpose of showing how much more profitable it was than any of the other sorts of timber sold at the same sale, and the return per acre that might reasonably be expected from it at such prices. All I would say about the other species of poplar is that they are not to be compared in any way to the black Italian as a useful and profitable crop.

I shall always be glad to enlighten an "unlearned but willing student," but whatever I may have time to write for your journal in future must be taken for what it is worth, as I shall decline to reply to the correspondence of critics, either "amateur" or otherwise.

Hopetoun, June 15th, 1877. JOHN MCLAREN.

SIR —The tree Mr. McLaren, forester at Hopetoun, has taken notice of in his letter in page 9 of your first number is certainly a large one. The tree was fifty-three years of age, contained eighty cubic feet, and was sold at £8 12s. 6d.

Some thirty years ago I cut down a black Italian poplar tree in one of the grass parks here, which measured eighty-four cubic feet at forty years of age. It was sold at 1s. per foot.

It stood between two other fine poplar trees, and it was removed to make way for the other two to develop themselves; and the largest of these now, I have no doubt, will measure 150 cubic feet.

I know a very enterprising proprietor near Aberdeen, who has planted probably not less than 3,000,000 black Italian poplar trees within the last seven years.

To a limited extent and upon a suitable soil, there is no question that a crop of black Italian poplar is the most remunerative crop of any tree that can be planted of all our forest trees.

Permit me to inform your amateur correspondent, that some of the principal purposes for which poplar timber is used are the following :—

Brakes for railway carriages, and for trucks, for which there is a large and steady consumption at all times ; for cleading (lining) railway trucks, stone carts, wheelbarrows, &c, &c.

Scone, Perth, June 26th. WM. MCCORQUODALE.

SPRUCE TIMBER.

SIR,—Like many others I have been much gratified by the perusal of the two first numbers of our journal. The catholic spirit manifested in its pages is sure to commend it to all those whom it proposes to benefit. It will be necessary, however, for a time to exercise a little caution when taking notice of the various matters that come under our consideration, for we must remember that foresters have been living in a kind of enforced isolation in the past, being almost entirely shut out from that mutual intercourse that does so much to help forward the general good, and as a necessary consequence of that, there has grown up almost unconsciously amongst us a restricted view of each other's work and experience. For example, the discussion on the merits of *spruce timber* which has already appeared in our paper, has brought before us two conflicting views on the subject, and I believe the gentlemen holding these views have goodand substantial reasons for so differing. Mr. Smith, in the *Timber Trades Journal*, has spoken very strongly against it, both as regards its quality and durability, while on the other hand we have the opinion of two gentlemen who speak with all the weight of many years' experience, and who say that it is an excellent wood suitable for all ordinary purposes, as well as being very durable. Now the question is, which of the two opinions are

we to believe? I say that we can believe both; for in justice to Mr. Smith I can testify that the quality of spruce timber on this estate corresponds exactly with the low estimate which he has formed of it. It is short in the grain, it rots very quickly, and in no case is it ever used except for the roughest boarding or fencing; and the simple explanation of this difference is that the quality of spruce timber varies exceedingly in different localities. In the north of Scotland it appears the climate and soil produce a compact, durable timber, while here, and I have no doubt in other places also, it is the reverse. It is a well-known fact that the quality of ash differs considerably, even within the bounds of a single estate, and I have no doubt that this applies in the same way in accounting for the differences of experience in regard to spruce timber.

ROBERT BAXTER,
Forester.

Dalkeith Park.

PRICES OF TIMBER.

SIR,—In the last number of the Journal I see parties calling in question the prices reported to have been obtained for certain classes of trees. I can easily understand how such high prices are got for first class and large trees, as in the case of a first class horse or cow; but how the price of an acre of larch in Kent so far exceeds that of our Scotch counties, is entirely beyond my comprehension. Mr. Duff, Forester, Bayham Abbey, reports to the Scotch Arboricultural Society that he sold larch ten years planted at the enormous sum of £72 per imperial acre, and says he heard on good authority that £100 was obtained on a neighbouring estate for a fifteen years crop, and asks, What system of forestry can equal that? I answer none, except that famous one of Mr. Brown's, by which he says he sold the crop for £509 odd per acre, being equal to three times that obtained by any other forester of the present day, excepting Mr. Duff. But speaking advisedly, I say that in both cases the prices are only imaginary, as £150 per acre for a crop of good timber sixty years of age, when no selections are made, is about the highest figure obtained by any forester of the present day, themselves excluded. I have made a reckoning at the prices reported to be obtained by Mr. Duff for hop poles, and after allowing 170 plants per acre to have died or grown deformed, and counting the remainder to have averaged thirteen feet in length, and at an average of the four prices he names, viz., for ten, twelve, fourteen, and sixteen feet poles, I find the mean price to be 17s. 5¾d. per 100 as the selling price. This would give a return of about £59 8s. 7d per acre, being £12 11s. 5d. short of his return in full, while I must deduct fencing, draining, plants, and planting, as well as all subsequent expenses in their after management. Need I further expatiate upon such a subject? or imagine for the reader the results likely to accrue? Can we, by only giving our employers a return of about £3 per acre,

and in some cases not more than £1 10s. per acre for our woodlands, expect to retain their confidence or esteem? or shall we wonder if dismissed their service, and told that no forester, unless trained in Kent under the superintendence of some specially gifted individual, is at all capable of performing the duties of forester? Nay, we might rather wonder their patience lasted so long, when men can be got that will give them £432 for every £150 we are now doing; and this only at rare intervals, or when the choicest of their trees happen to be cut down. But we may safely tell them that no Kentish forester will give them these prices, for precious as these hop poles are, they cannot grow on earth alone to produce these glowing figures they read of in this paper of Mr. Duff's. Our profession is a noble and a grand one, and needs no extraneous aid to elevate it in the eyes of our fellow countrymen, as our handiworks, in combination with that of the Creator, produce at once a pleasing object to the eye, and confer benefits in various ways upon all mankind, while it also provides a favourite subject of study to many wise men engaged in seeking to reduce the cause of our distress, and alleviate the painful sufferings endured by our race.

To junior and inexperienced brethren I would say, "Test all things by the light of truth," and let the same light lead and guide the heart and pen of more experienced ones; and thus we shall, through the medium of our favourite journal, diffuse a beneficial and benign influence around us.

PRO BONO PUBLICO.

THE GOLYNOS OAK.

SIR,—In *Times Telescope* for 1816 are given a few particulars of this "*rare stick*," in addition to those mentioned in page 70 of your first number. The main trunk, at 10 feet long, produced 450 cubic feet; one limb, 355; one ditto, 472; one ditto, 235; one ditto, 156; one ditto, 106; one ditto, 113; and six other limbs, of inferior size, averaged 93 feet. each: making the total 2426* feet of sound and convertible timber. The bark was estimated at six tons; but as some of the heavy body bark was stolen out of the barge at Newport, the exact weight is not known. Five men were twenty days cutting down and stripping this tree, and a pair of sawyers were five months converting it, without losing a day (Sundays excepted). The money paid for converting only, independent of the expense of carriage, was £82. In sawing it through, a stone was discovered six feet from the ground, above a yard in the body of the tree, through which the saw cut; the stone was about six inches in diameter and completely shut in, but round which there was not the least symptom of decay. It was sold *standing* for £105, and the whole produce of the tree was, as stated, within a trifle of £600; see *Monthly Review* for 1816, page 335 (Volume 81, new series). With reference to the price of special

* The total of these separate items is 2445 feet.

and fine grown oaks, it is said that during the long war there were 100 picked oaks sold out of Nun Appleton Park, by the then Sir William Milner, for £100 per tree, realizing the handsome total of £10,000.

G. I. Cooper.

PRUNING.

Sir,—I would with much diffidence beg to call attention to a subject of great importance in forestry that was brought before us in the first number of our journal. I refer to the new theory in reference to pruning advanced by Mr. Hutchison (see page 15), where he brings in the human subject as an illustration of his argument. I do not call in question the "hospital statistics" which he adduces, but I object to the conclusions which he draws from them. He says that amputations when performed on the human system between the ages of thirty and fifty years are fatal in the proportion of one in two, and from that he assumes (he certainly does not prove) that pruning operations performed on trees of the same age will yield the same unfavourable results. Now it will occur to our readers that before we can make any comparison between these two subjects, there must be some essential quality in them common to both, by which we can judge and decide as to the results of operations performed upon them in the way mentioned. Unless we can do this the argument falls to the ground, and in the present instance I am afraid that instead of finding any traces of affinity between them, we shall only find indications of their complete dissimilarity. For, let any one look upon a human limb that has been operated upon by the surgeon's knife, and reflect upon the shock that is given to the human system, so peculiarly sensitive to the slightest injury, by an operation of this kind, and say if there is any resemblance in it to the hard insensate wood that is cut through by the woodman's saw. If there is any at all, it is so very slight that it will never warrant us founding a theory upon it in regard to one of the principal duties a forester has to undertake. Further, the object aimed at in both cases is totally distinct, when a limb is severed from a tree it is done in almost every instance in order to produce a uniform development of all its parts; whereas in the case of an amputation it is not symmetry but a life that is at stake. A forester can, when occasion requires it, cut the entire top off a tree with very little compunction, knowing that in a few years another and perhaps a better top will grow on. But the analogy entirely fails when applied to a human being, seeing then that the two things are quite distinct in their common properties, and are also operated upon in order to accomplish different results. We are thus led up to the conclusion that no reliance can be placed on a theory that founds itself on a supposed analogy existing between them. I would say further that there is no need whatever of going to the surgeon's books in search of statistics on this question. Because we have hundreds of men all over the

country operating upon trees with a fair amount of skill and knowledge for some months every year, who could furnish full statistics bearing on all the various points connected with pruning; and if all these results were gathered up and compared, we should then have no difficulty in coming to a safe conclusion on the whole question. No doubt it will take years before this can be accomplished, but surely no one will grudge either the time or the labour necessary to attain such an important result.

ROBERT BAXTER.
Forester.

Dalkeith Park, 14*th June*, 1877.

THE POPLAR TREE.

SIR,—Under the above heading, at page 112 of last number, "An Amateur" says, "I am aware there is a valuable wood in Canada known as *hacmetac*,* which is, I believe, a species of poplar, ... But whether we have this tree, and what its habits of growth may be, I do not know;" and goes on to ask some forester on the other side of the Atlantic to enlighten him on this tree. Perhaps the following description of this "species of poplar" will suit "An Amateur," and interest others. Haematack, tamarac, or larch, is *Larix Americana*, and common in Ontario, where it grows to be a tree from 6′ to 10′, rarely exceeding twelve inches diameter, and from 50 to 100 feet high. It has a geographical distribution from Nova Scotia to Minnesota, from Southern Pennsylvania to North of Lake Superior. The timber is harder and heavier than white pine, and much more durable. In the Atlantic Provinces haematack grows to be a much larger tree. Its favourite habitat is marshy swamp, and there are some extensive tracts in which no other tree grows. On the St. John, Miramichi, Richibucto, and other rivers, ships of the largest class are built with this tree, and only finished with white pine and black spruce. *Larix Europea* grows to be a much finer tree than *Americana*.

D. SYM SCOTT, Forester.

Ballinacourte, Tipperary, 3*rd June*, 1877.

* ["An Amateur" has evidently confounded "Haematack," *Larix Americana*, or *pendula*, with "Tacamahac," *Populus balsamifera*, both natives of North America.—*Ed. J. of F.*]

The Yew—Taxus baccata.

Yew is supposed to be a corruption of יהוה Jehovah, immortal. It loves the solitary churchyard, lone mountain-side, and every out-of-the-way corner. Turner, 1664, remarks :—"The yew is hot and dry, having such attraction that if planted near a place subject to 'poysonous' vapours its very branches will draw and imbibe them. For this reason it was planted in churchyards, and commonly on the west side, which was at one time considered full of putrefaction and gross oleaginous gasses exhaled from the graves by the setting sun. These gasses, or 'will-o'-the-wasp,' 'divers' have seen and believed them dead bodies walking abroad." Turner continues to tell us that "where so ever it grows, it is both dangerous and deadly to man and best; the very lying under its branches has been found hurtful, yet the growing of it in churchyards is useful." Galen and Dioscorides both wrote of the yew as venomous if taken inwardly, and if "a doe sleep under its shade it causethe sickeness, and ofttimes deathe." Even if birds were to eat the fruit they would lose their feathers. Meander, 1771, reckoned the yew the most "poysons" of plants. "If eaten, doth cause death unless pure wine is at hand, which will make life grow 'strait.'" Theophrastus says, beasts that labour will, if they eat the tree, die, but such as chew the cud receive no hurt. Gerarde, 1598, on the evil effects of the tree, says, "All which I boldly affirm as untrue, because I have eaten my full of the berries and slept in the branches, not once, but oft, without hurt." Lobel observes that in Britain the tree is not poisonous, but in hot countries it has such "malignant qualities." It is not well established why it of all trees was planted in churchyards. John Ray says, 1665, as an emblem of immortality; others, to be out of cattle way, while yet some others affirm because being used for the sprinkling of holy water, and therefore must be grown on consecrated ground. Sir Thomas Brown, 1658, thinks that as the Christians used to decorate their coffins with yews as immortals and *which taking root grew into trees.*

In Catholic countries yew is used on Palm Sunday, and may have been planted in churchyards to be at hand on such occasions.

The Ankerwyke yew was a tree of considerable size in 1215, at the signing of Magna Charta. At Fountains-Abbey, Yorkshire, there is one reckoned at 1,200 years of age. St. Pierre, in 1772 saw one in

Lower Normandy which was planted in 1066. Near Warblington, Hants, is one 27 feet in circumference. Crowhurst, Surrey, has one 30 feet 6 inches. At Leeds is one 31 feet round. Inchbrakie, near Crieff, Perthshire, has the second largest yew in Scotland, which during a season of peril sheltered the great Montrose in its dense branches on one occasion. Of all these, Fortingall, Glen Lyon, Perthshire, bears the bell. In 1772 it measured 57 feet in circumference. Considering the slow nature of its growth, Pennant's tree at Fortingall must have been a wonderful sapling at the beginning of the Christian era! Evelyn saw the hills of Surrey clad with yews. The Darley yew, Derbyshire, is reported to be the largest in the world. Besides being a charm for driving away the devil, a doctrine inculcated by monkish superstition, the tree was venerated in the early ages. At one time it was a stipulation in the trade for merchants to import from abroad annually so many rods of yew for bows.

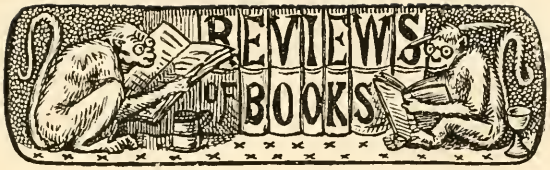
L. Fitt.

Expenses of Carriage on Timber to the Portsmouth Dockyards in 1792.

The Commissioners appointed to enquire into this and other kindred subjects at the above date, report as follows: The supply to Portsmouth from the New Forest was the principal one, and therefore being so near it was not tabulated, as it was probably thought that that forest must be exhausted before any great drain was made on the others. The freight from New Forest to Portsmouth was, however, 15s. 1½d. per ton, and from the other forests as follows:—

From Alice Holt	£1	8	0
„ Whichwood	1	5	0
„ Dean	2	10	0
„ Whittlewood, by way of Oxford	3	12	0
„ „ „ Hertford	3	15	0
„ Salcey	3	18	0
„ Bere	0	8	6

and from Waltham Forest something less than Bere.



Pinacea: A Handbook of the Firs and Pines. By SENILIS.
Hatchard and Co., London.

The aim of this treatise as the author tells us, is to supply what he terms one of the many "wants" of arboriculture, viz., "A handbook of the firs and pines, giving their distinctive characteristics and the best modes of growing them; with brief practical notes on their hardiness, and on the soils and situations most suitable for them; showing such kinds as are of economic value for their timber, and such as are useful for ornamental planting in the climate of Great Britain and Ireland; also a natural and common sense classification and nomenclature of them, with an alphabetical list or index of the names of all the genera, species, quasi-species, varieties, and sub-varieties, and all the synonyms and aliases by which they are at present known; comprising a brief and practical summary of all that is desirable or necessary for the British arboriculturist to know concerning the firs and pines of the world to the present date; and all this in a portable form, and at a reasonable price."

After reading in the preface such an "excelsior" summary as we have quoted of the objects the author had in view in writing the book, we entered upon a careful perusal of its contents, with high expectations of being well rewarded for our trouble, by being intelligently, clearly, and concisely informed and instructed upon the nature, habits, cultivation, and uses of firs and pines; their adaptability to our climate; and above all "a natural and common sense classification and nomenclature of them." We lay down the volume with the impression that the author has utterly failed to carry out the brilliant programme he has sketched for himself, but if nothing else, he certainly proves himself to be fairly original and egotistical to a degree, and instead of giving us a clear and intelligible "common sense classification," for which we would be the better, he only makes confusion worse confounded by a mass of verbosity and egotistic pedantry that is painful for a common sense reader to wade through.

Any of our readers who have a taste for such things may peruse the book for their own satisfaction, but we forbear to quote any of the absurd notions and ridiculous cant and rant of the author, who quotes Holy Writ much too freely, and as liberally rants at all and sundry who have the misfortune, or rather we should say good fortune, to differ in opinion from him. On the whole the book is a great curiosity in its way,

displaying a much more intimate acquaintance with the ancient classics than with modern arboriculture, Sanscrit, Hebrew, Greek, and Latin being quoted as glibly as the mother tongue, which may show a considerable amount of classic learning, but is a poor excuse for such a small modicum of sound practical and scientific arboriculture, and the want of common generosity.

The Practical Timber Merchant. By W. RICHARDSON.
London : Crosby Lockwood and Co.

This handy manual "is intended for the use of all who are either timber merchants, builders, joiners, carpenters," and we will add the growers of timber trees as well, foresters in particular, who willfind in it much valuable information and interesting facts in regard to the growth, strength, and selection of timber ; fancy woods and their principal distinguishing marks ; lathwood ; sawing and planing ; and the creosoting of timber ; with well got up, clear and comprehensive tables showing the price per foot run of various sizes of timber, and its equivalent per Petersburg standard ; the price per cubic foot, and its equivalent per load of 50 cubic feet ; the cost of a 12 feet length, at a price per 120 12 feet lengths, irrespective of width or thickness ; cost of sawing and planing of all descriptions ; price per Petersburg standard of boards at any price per running foot ; price per superficial foot of boards of various thicknesses at per cubic load or foot ; the value of different scantlings in pence per foot run, according to the price per cubic foot of timber ; reduction of any number of running feet of various dimensions to the Petersburg standard; the weight of a cubic foot of timber of various descriptions, and other building materials ; railway, &c., carriage tables ; and a table showing the relative value of the Petersburg standard to various other standards ; with a variety of information on other matters concerning timber ; all of which are of much use and interest to the forester and all others connected with the growth, sale, and manufacture of timber.

From the interesting chapter on the growth of timber we quote the following in reference to the well-known *Sycamore* or *Great Maple*, known as the plane tree in Scotland :—"Frequently we hear of the sycamore abused as not worth growing for the value of its timber, and devoid of beauty of outline and picturesque effect as an ornamental tree. We, nevertheless, agree with Sir T. D. Lauder, that it is certainly 'a noble tree.'"

Turner, writing in 1551, and Gerard in 1597, both describe it as being a stranger to England ; and Ray speaks of it as a tree common to courtyards, churchyards, avenues, &c. Upon the Continent the sycamore is spread over the greater part of Middle Europe, affecting wooded mountainous situations.

In Switzerland, where it abounds, it reaches, according to Loudon, an altitude as high as 3,000 feet above the level of the sea. From the strength of its spray, and the nature of its growth, which is stiff and angular, the sycamore is better calculated than any other tree with which

we are acquainted, except if it be its congener, the Norway maple, to act as a shelter or break-wind in exposed situations. It is used in the north of England and in Scotland for machinery and for the ends of herring barrels, for which it is preferred to that of any other by the coopers, and for which purpose it is fit as soon as it has attained a diameter of four or five inches, which it frequently does in favourable soils in the course of twenty years.

The wood is firm, of a close, compact grain, susceptible of a high polish, and easily worked. It is not subject to be worm-eaten, or to warp, and works well in the turning lathe. In England it has generally been applied to minor purposes and indoor articles, such as cheese and cider presses, tables for common use, mangles, &c.; and when wooden dishes and spoons were in common use, they were mostly made of this wood; it is now, however, extensively used, when of sufficient scantling, for machinery, also in printing and bleaching works for beetling beams, and in cast-iron foundries for making patterns; for all of which purposes it brings a high price. The roots, being frequently beautifully and curiously veined, afford a valuable material for inlaying and other cabinet-work. As a fuel, it is unequalled for the quantity of heat it throws out, and the charcoal made from it is of excellent quality, and surpasses that of the beech in the proportion of 1,647 to 1,600. An experiment made by Sir T. D. Lauder showed that 116 of sap yielded 1 part of sugar, very sweet, but of a peculiar flavour. The sap is also sometimes made into a wine, but is inferior to that extracted from the birch.

The best soil adapted for the sycamore, and in which it attains its greatest size, appears to be a rich dry loam with a mixture of gravel. It grows, however, in almost any soil not saturated with moisture, and occasionally attains a fair size in thin and inferior soils. It is of rapid growth, and reaches its usual height in sixty years; the wood, however, continues to improve till it is eighty or a hundred years old, and it frequently continues undecayed for another century.

There is, or was, a sycamore in Mutford Park, near Morpeth, Northumberland, 11 feet in length before the first great ramifications, measuring near to the ground 22 feet in circumference, and 16 feet a little below the branches, and containing 327 feet of timber. At Twizell the sycamore, 25 years planted, is 35 feet high and 12 inches in diameter.

The author discourses in a similar instructive and interesting manner on the various kinds of timber trees grown in this country, and then gives an excellent essay on the strength or bearing power of timber in as plain and popular a manner as the nature of the subject will permit of, so that the merest novice may understand it and profit thereby. In the chapter on the selection of timber he remarks,—"Freedom from knots and sap, and a straight close grain, are qualities to be desired in wood; but as trees cannot grow without sap and knots, the aim of the buyer must be to select his wood as free as possible from these defects. Deals, &c., should be selected square at the edges. When they are otherwise, or 'waney,' as it is termed, it generally shows that they have been manufac-

tured from the sappy or inferior part of the tree. . . . It is seldom that wood that looks well to even an inexperienced eye turns out badly. Were it not good, and likely to command a fair price, the foreign merchant would not take such pains in its manufacture. A good colour throughout, and square edges, imply tolerable freedom from sap and wane. Knots and shakes speak for themselves."

With reference to the process of preserving timber by creosoting, invented by Mr. John Bethell, of London, in 1836, and still carried on largely by his firm and others, the author says,—"It consists in placing the timber in a large cylinder, which is hermetically closed; and in the first place, exhausting the air from the cylinder, by which means much air and moisture can be extracted from the pores of the wood; secondly, in filling up the cylinder with creosote oil and pumping it by hydraulic pressure into the timber till the latter has absorbed from eight to twelve pounds of creosote per cubic foot.

"Creosote is an oil of heavy gravity obtained from coal-tar, from which it derives much naphthaline and crude carbolic acid, both powerful antiseptics.

"The idea of impregnating timber with creosote was suggested to Mr Bethell by the perfect preservation of Egyptian mummies embalmed in. petroleum. The creosoting process (if conscientiously performed) appears to respond to all the requirements of science, and to be likely to preserve timber until it is worn out by mechanical action. It fills the woody cells, and protects the fibres by an elastic india-rubber like substance, effectually excluding air, moisture, and heat, the presence of all of which are required in order for decay to begin.

"After a few months creosoted wood gives a metallic sound when struck, and is almost too hard for carpenters' tools to work upon, though, at the same time, it possesses an elasticity superior to that of any but greenheart timber unprepared. Creosoted wood completely resists the attacks of all sea worms, insects, and white ants, and is almost universally required by engineers in places where these troublesome animalculæ exist. Its use has become general, with only one or two exceptions, on English and Irish railways. A creosoted sleeper has been known to wear out three or four sets of rails; whilst, in the case of uncreosoted sleepers, the rail generally lasts the longer.

"Creosoted timber is prescribed on the Belgian and Dutch State railways, even oak being creosoted. In Germany it is used on a very large scale, even in districts where sleepers are most plentiful and cheap. In France it divides the ground pretty equally with the sulphate of copper process, which injects precisely in the same way a solution of the salt 5 per cent. strong." Her Majesty's post office authorities have all telegraph poles creosoted except larch, which is too resinous to permit of due impregnation. The excellence of this process is generally recognized, and the inventor has been awarded several international exhibition prize medals in recognition of it.

The Timber Merchant's and Builder's Companion. Third Edition. By WILLIAM DOWSING. London: Crosby Lockwood and Co.

An exceedingly well-arranged, clear, and concise manual of tables for the use of all who buy or sell timber, containing copious tables of the reduced weight and measurement of deals and battens of all sizes, from one to a thousand pieces, and the relative price each size bears per lineal foot to any given price per Petersburg standard hundred; the price per cubic foot of square timber to any given price per load of fifty feet, besides a variety of other information, which will be found most useful to the forester, timber merchant, and builder, in saving much time in making calculations of the measurement, weight, and price of timber. The size, weight, and cost of any given piece of timber can be found in an instant, with perfect accuracy; all who have to do with wood ought to possess this valuable ready reckoner.

Along with numerous other magazines, periodicals, &c., which have reached us lately, we may mention the *Farmer's Magazine*, Rogerson and Tuxford, London. A monthly journal full of valuable information to the agriculturist and land proprietor, in which are duly recorded all items of importance about what is going at home and abroad likely to be of interest to the farmer and others who have to deal with or manage land and stock. The *American Farmer*, Baltimore, U.S., a journal similar to the above, but specially suited to the wants of farmers in the United States, and containing a rich store of information, which is no doubt taken full advantage of and highly appreciated by those for whose benefit it is intended. The *Gardener's Monthly and Horticulturist*, Philadelphia, U.S., one of the best of the American horticultural magazines, full to overflowing of seasonable hints upon all gardening matters, and also devoting a few pages to matters pertaining to forestry, which is receiving increased attention in the United States since the primeval forests of the eastern states have been ruthlessly demolished, and the people have begun to feel severely the want of trees for shelter, ornament, timber, and fuel. The *American Agriculturist*, New York U.S., a Magazine for the Farm, the Garden, and the Household, which is perhaps the ablest and best conducted periodical treating of all imaginable rural affairs in America. We have also received *Tatham's Timber Tables*, printed on both sides of a card, seven inches by five inches, too large for the pocket, and not at all handy in its present shape, although the tables are most useful. On another neat and handy card, suitable for the vest pocket, is the following useful memorandum:—

TATHAM'S TIMBER RHYME.

SIX girt is a QUARTER, so we have heard,
But SEVEN ditto will be found a THIRD;
EIGHT and a HALF is the HALF, without trouble,
TWELVE is the WHOLE and SEVENTEEN the DOUBLE;
Take HALF for LARGER GIRTS, and FOUR TIMES the contents find,
The same for GREATER LENGTHS, but DOUBLE the contents, mind.

The American Poplar (Anglice, Tulip Tree) Lriiodendron tulipifera.

This is by far the finest tree in our forest. Nowhere does the poplar attain greater dimensions than in West Virginia. It often reaches the height of 120 to 140 feet, and the diameter of seven to eight and nine feet, with a distance of 80 feet from the first limb. Several trees are reported as 10 and 11 feet in diameter in this State. It delights in deep loamy and extremely fertile soils, such as are found in rich bottoms and on rivers or swamps. It will grow, however, on soil of different kinds, but has its timber affected accordingly. A deep sandy loam seems best for it. To attain the greatest size it must be sheltered from the high winds, and at the same time have light and air enough to ripen its wood. It is generally propagated by the seeds. The timber, though classed among the light woods, is yet much heavier than the true poplar, for this tree is properly called tulip tree, and not poplar. Its grain is fine, rather compact, polishes well, and is easily wrought. When dry a cubic foot weighs 25 lbs. It affords excellent charcoal, yielding 22 per cent. The heartwood, perfectly seasoned, long resists the action of the weather, and is rarely attacked by insects. When not perfectly seasoned, however, it is apt to warp under alternations of dryness and moisture. The nature of the soil on which it grows has a striking effect on the colour and quality of the wood. Mechanics distinguish three kinds, white, blue and yellow. No external marks will distingnish them positively. In general, the white poplar grows on dry, gravelly, elevated ground, and has a branchy summit, with a small amount of heartwood. The grain is coarser and harder, and the wood decays more rapidly. The blue has the same general character. The yellow poplar is by far the finest kind, and has all the qualities required for a great variety of uses. It would take too much space merely to enumerate all of these. It is used extensively in the interior of houses, for shingles and for weather boarding. Large quantities are used in making trunks covered with cloth or skins ; for tables, bedsteads, seats of chairs, &c. ; for the supports of veneers, inner work of bureaus, &c. ; in winnowing machines ; for bowls, broom handles, rails, and planking for fences ; for the backing of picture frames, looking-glasses, &c., it is employed. The bark of the tree is considered by some hardy inferior as an antiseptic and tonic to the cinchona. The aromatic principle resides in a resinous matter in the bark, and when used stimulates the intestinal canal and acts as a gentle cathartic. In many instances the stomach cannot support it unless accompanied with a few drops of laudanum. The bark, mixed with an equal amount of dogwood and steeped in whisky, forms a tincture used as a remedy for intermittent fever. The bark reduced to powder and given to horses is a pretty

sure remedy for worms. The poplar is one of the most generally diffused and abundant trees in the state. Great quantities of the finest trees are to be found in the central and southern counties. Perhaps some of the largest timber is met with on the affluents of the New, and Kanawha, and the Big Sandy rivers.

Philadelphia, U.S.A. BURNET LANDRETH.

The Highland and Agricultural Society.

The half-yearly meeting of the members of this affluent and useful agricultural society was held in Edinburgh on Wednesday afternoon; Mr. Robert Hutchison, of Carlowrie, senior director present, presiding. New members to the number of 186 were enrolled. In reference to the summer show, which is this year to be held at Edinburgh, it was reported that judging would commence at 11 a.m. on Tuesday, July 24th, instead of at 1 p.m., as has been the case on the opening day for some years back. The amount of prize money offered is the largest the society has ever given, yet the entries are not so numerous as might have been expected. Of cattle there are 350 entries, horses 310, sheep 540, pigs 40, implements 2250. Except in sheep, the entries, however, compare favourably with those for the last Highland show held at Edinburgh in 1869. A handsome gold medal is to be given by the Marquis of Tweeddale, in memory of his late father, to the best shorthorn bull or Border Leicester tup in the yard which will be a new feature. The implement entry is the largest the society has yet had.

At a meeting of the directors held immediately before the general meeting, it was resolved by a majority to publish the names of the gentlemen who had consented to act as judges in various classes as soon as the acceptances were all intimated to the secretary. This proposal was submitted to the general meeting, and was passed without comment; but there were few members present, and scarcely any exhibitors of stock among them. This resolution will take many members of the society and exhibitors of stock generally by surprise. We believe that the feeling is so strong on the matter in certain quarters, that an attempt will be made at next meeting of the board to rescind the resolution.

Several alterations were made in the rules and bye-laws affecting the examinations of students for the society's diploma, and certificates awarded for proficiency in the science and practice of agriculture, not the least notable of which is the abolition of the rule requiring candidates to be under a certain age. Some changes were also made in the arrangements for the examination of veterinary students for the society's medal and certificates.

The report of the chemical committee, read by the convener, Mr. Mackenzie, of Portmore, stated that the society had resolved to accept of land

offered by the Earl of Wemyss and by Mr. Maclagan, M.P., for the two agricultural experimental stations in the Lothians, formerly sanctioned by the members of the society. It was further stated that the Marquis of Tweeddale was very anxious to afford the society every facility for carrying on the field experiments on his property at Yester. In these circumstances the committee asked permission to accept of his lordship's offer if the available funds would admit, and thus form a third station in the Lothians. The meeting readily granted this permission. The convener reported that the directors had unanimously selected for the office of chemist to the society, or scientific conductor of these stations, Dr. Andrew P. Aiken, Edinburgh, at an annual salary of £300.

Dr. Aiken sketched the course which he and the committee at present intended to pursue in instituting and carrying on the experiments in question. The aim of the committee was to ascertain, if possible, the respective agricultural values—that is, the value to the farmer—of the various fertilisers commonly used. With this object in view, a complete set of experiments would be conducted, not only in the field, but in tanks or pots in open air, and in pots and tanks under glass. Each station was to be 10 acres in extent, and these acres were to be apportioned into forty plots. On one part of the station they were to start with experiments to determine the comparative value of the different phosphatic manures now commonly in use; in another part they were to test the value of the various nitrogenous manures along with soluble and insoluble phosphates. On another part they intended to test the efficacy of the different kinds of salts; on another part, the value of sulphuric acid. The continuous corn-growing system is to get a trial, and so is the natural fertility of the soil, unaided by fertilisers. It is also intended to endeavour to ascertain the comparative results of using the common ammoniacal guanos, and the artificial imitations of these guanos. The experiments to begin with are thus to be confined to the various artificial manures; but Dr. Aiken intimated that the committee were not wedded to their scheme in its entirety, but, on the contrary, would be glad to receive and favourably consider suggestions from members of the society on the subject.

Mr. Thomson, of Holms, gave notice that at next meeting he would move that in future the large committee having charge of the show arrangements for the year should be nominated, one half by the commissioners of supply for the counties specially embraced by the show, and the other half by the members of the Society resident in those counties. Hitherto the committee has been elected by the commissioners of supply only.

Canadian Log House at the United States Centennial.

To a lover of nature interested in forestry one of the most pleasin features of the International Exhibition at Philadelphia was the display of native woods from all parts of the world. Nearly every country participating exhibited a full collection of the wood growth native to its soil. This was done in a variety of ways, by logs, sections, planks with and without bark, rough and dressed lumber, polished woods, and manufactured articles. There was great difference in the degree of skill displayed by the various commissioners in arranging these collections, so as to show the many points of interest, and in this particular the Japanese far exceeded all others. By a very simple yet ingenious and tastefu arrangement they exhibited a large variety in a remarkably condensed form, but with details complete. A single piece of each kind of wood was entered, a half cylinder, about four feet in length, so cut and prepared as to show, in each case, the size and nature of growth, bark and wood, heart and sapwood, transverse and diagonal sections, rough, dressed and polished surfaces, while to each there was attached (as a rule) a preserved specimen of foliage, flower, and fruit.

The Canadian log house was decidedly the most unique and picturesque of all the special exhibits. At once a monument to nature's rich endowment and the leading industry of the Dominion, it was such an attractive and instructive object that it merits a full description.

Let it be noted, in passing, that omitting the provinces of Manitoba and British Columbia, with their vast area of over 3,000,000 square miles, but one-tenth of the soil of Canada is open to cultivation, while the greater portion of the remainder is clothed with primeval forests; this building, therefore, represents the chief natural product of nearly half a million square miles of British territory.

This interesting structure is, to all appearance, a building, and yet in reality only a pile of logs and merchantable lumber of every form Porticoes, hall, salon, stairways, attic, balcony, and cupola, all are formed by ingeniously piling the lumber of different kinds, few fastenings being visible. The building is peristyle in form, with nearly flat roof, surmounted by a four-faced pyramidal tower, and occupies a ground space of sixty feet by forty. The sixteen columns which sustain the roof are single logs of ash, beech, birch, butternut, chestnut, cherry, elm, hemlock, sugar maple, white maple, white, red, and yellow pine, poplar, spruce, and walnut, no two of a kind, all fifteen feet long, and ranging from three to four feet in diameter at the base; the six columns on either side rest upon a single stick of timber, as sills, of white pine, sixty feet long, squared by sawing forty inches by thirty-six inches.

In the front portico is a pretty substantial table; the legs are sections of sycamore, black ash, alder, and pear trees, each two and a half feet diameter, and support as a top a single plank of Douglas pine from Vancouver Island, fourteen feet long, eight and a half feet wide, and nine inches thick, which was cut from a tree 603 years old, 289 feet high, and measuring twelve feet in diameter at the ground. As a centre-piece on this table there is blocked up on edge a section of an immense log, with this inscription :—Canada white pine, 664 years old, 303 feet high, section of four feet, diameter eight feet five inches, weight 7,500 lbs. This is from a log forty feet long, cut at Ottawa, Ontario. Think of a growth of plants thickly set like these pine forests, whose trunks weigh nearly a ton to the lineal foot!

It is impracticable to describe in full the numerous kinds of wood, and the sizes and shapes of the great variety of forms in the lumber shown, or to give any adequate idea of the pleasing effect of their artistic combination. Among the notable pieces are these,—ash columns, turned and polished, fourteen feet high, three feet diameter at the base, and twenty nches at top of shaft, these inside the porticoes supporting the covering and standing upon sections of spruce logs four feet in diameter. Numerous oiled and polished planks ten to twelve feet long, all at least four feet wide, of white cedar, pine, sycamore, cherry, black walnut, "white soft walnut," and "red walnut,"—these walnuts very beautiful woods. Among the rarer kinds of merchantable lumber, in large sizes, basswood, "arbutus," whitewood, alder, dogwood, pear, red cedar, and balm of Gilead (*Populus candicans*). And the great variety of forms include, besides all sorts of building lumber, ship knees, spars, masts, wheelwrights' and coopers' stuff, and "bandbox wood," cut sixteen to the inch in thickness.

The lighter materials, clap-boards, laths, and shingles, are used for balustrades, pendants, and other finishings, with good effect, and to relieve the otherwise rather monotonous lumber-yard colour, lime washes, red, white, and blue, are applied in good taste; this being at the same time a delicate and neighbourly Canadian compliment to "Uncle Sam."

Outside the structure, apparently as rejected materials, stand the ruins of several monarchs of the forest, among them birch and elm logs over five feet through. And near by is erected a slender, graceful flagstaff of New Brunswick pine, 100 feet in height.

In the trimmings only are nails to be seen, everywhere else the needed strength and firmness is given by the ingenious arrangement of the materials; this fact is worthy of repetition, that this really ornamental and substantial edifice is actually but a fine collection of the assorted wares of Canadian lumbermen.

A large part of the materials used came from the Ottawa Valley, collected by the Quebec Advisory Board, but private dealers in different parts of Ontario contributed generously. New Brunswick is well represented, and some of the finest specimens are from British Columbia. I am sorry to be unable to give full credit, by name, to the designer or architect, indeed, his work was that of a true artist.

The building, so novel and attractive in itself, had the additional advantage of a conspicuous location upon the Centennial grounds; and as from its roof an admirable view of almost the whole enclosure could be obtained, it was daily visited by thousands.

This magnificent lumber exhibit, in matter and manner alike, was worthy of Canada and the Canadians.—"*Fairfax*," *in* "*Agricultural Gazette.*"

Rules for Willow Planters.

1st. Never transplant a willow if a cutting can be used, for all willows succeed better from cuttings than they do from rooted plants. 2nd. After planting, keep them clean; never allow weeds to choke or overpower them. 3rd. No willows do well in water-logged land, nor in peat bog, nor in dry sandy soil. The best soil for an osier plantation is a strong loam, and the most favourable position where they can be flooded at will and yet the land be well drained. 4th. In England, willows may be planted at any time from the middle of November to the end of March. 5th. If practicable, break up the ground by a steam cultivator, which is cheaper than ordinary trenching, and quite as good. This should be done early, to ensure the ground being in good condition for planting, for if cuttings be stuck into unbroken clods failure may be expected. 6th. In planting basket willows secure, at whatever cost, the best sorts, and free from mixture, taking care that the species is suited to the soil and adapted to the market; it is false economy to plant whatever comes convenient (a mixed crop is always of small value), and a willow plantation in suitable soil will last from fifteen to thirty years. 7th. When cuttings are planted with the view to grow into timber trees, cut to the ground, at the end of the first season, all crooked and defective shoots, for the first year's shoots seldom grow straight enough to be allowed to stand for timber trees. 8th. Protect all young plantations from ground game, for even the buds of bitter willow are not proof against rabbits or hares. 9th. Never pollard a willow; pollard willows decay, and in that state harbour destructive insects; better and straighter poles are obtained by cutting to the ground. 10th. Willows make good wind screens or nurse trees; and the long-leaved sallow, or *Salix acuminata* stand well on the sea-coasts or other exposed situations: some of the varieties of this species make good poles for fencing or general farm purposes, but they are not otherwise commercially valuable. 11th. After cuttings are put into the ground let the latter be firmly trodden down around them; many cuttings die from this being only partially done. 12th. Do not plant cuttings when the bark is much chafed or broken; on the contrary, throw them aside. 13th. Do not plant little corners with basket willows and expect such scraps to pay; it would be just as reasonable to plant a rood of ground with wheat and expect to make a profit out of it. If such bits are to be planted, plant them for poles or timber; in this form they will pay well, but they can never pay to cultivate for basket willows. 14th.

Willows will grow on land occasionally overflowed by salt water, provided it is suitable in other respects. 15th. In collecting willows for scientific observation or classification, avoid decision until you have grown them in a trial ground and compared them with others similarly situated, willows being so much altered by soil, situation, and climate as to be unrecognisable even by those who have studied them for years. If this plan be adopted, much of the confusion that now exists will be avoided, and many of the so-called species will be found to be only varieties. 16th. Willows planted on the banks of rivers are of great value in preserving the soil from being washed away, by reason of the grasp and tenacity of their long fibrous roots. 17th. At the present price of cuttings and labour, the outlay for planting basket willows, including everything, may be stated at 25s. per 1,000 cuttings, which at 20,000 cuttings per acre—the ordinary quantity—would be £25, and, unless under very exceptional circumstances, this may be taken as the ordinary cost of forming an osier plantation. 18th. The importance of planting quick-growing timber trees in a country so limited in area as ours is admitted; and the willow is not only one of the best trees for this purpose, but no wood sells more readily, nor is so difficult to obtain, nor will yield a greater return. 19th. All cuttings should be pushed from 8 in. to 10 in. into the soil, and in a slanting direction. 20th. The number of cuttings required for an imperial acre is as follows:—18 in. each way, 19,360; 24 in., 10,890; 36 in., 4,848; 48 in., 2,722.—*William Scaling, Bassford, Notts, in Agricultural Gazette.*

Preserving Fence Posts.

We extract the following remarks on this subject from the American *Country Gentleman*, and we invite our correspondents' opinions upon the methods they find most efficacious for preserving wooden posts in this country:—

"I notice in your pages the statement that 'it is always important to have a thorough bottom drainage for posts; and for this reason, if they are set over a drain, they will last longer.' I would ask whether this point has been proved by actual experience. If so, I must abandon a theory hitherto supposed to be based upon scientific principles, as well as the practical knowledge I thought I had gained from the testimony of others and from my own experience. Wood and other organic matter decay by combining with the oxygen of the air, but water is needed to effect the union. Consequently, if wood be kept absolutely dry, a limit could scarcely be assigned to its durability. If the air be excluded by water, or by earth saturated therewith, the result is nearly the same.

"Of the first fact we are constantly reminded by the care necessary to preserve buildings and wooden articles from injury by water, while that which lies safely buried, subject to no changes, and needing no care, is forgotten. Builders, however, will use the most perishable woods under water as foundation for costly and permanent superstructure. The houses of Venice have stood for many centuries upon piling twenty feet in length,

and had these decayed the result must have been plainly visible; but a leaning wall is hardly to be seen in the city. And I am informed that there still exists in England piles driven by the army of Julius Cæsar. My neighbour has tried filling around his posts with cobble stones instead of earth. They are thus kept comparatively dry, and he has found them to outlast those set in the ordinary way, and to keep their places better. Those who have no stone might accomplish the first result by draining, if they could thereby remove all the water from the soil. But the *Country Gentleman* teaches that land suffers less with drought after being thoroughly drained: that the soil not being solidified by a superabundance of moisture is enabled to retain more for a time of need; that the air permeating the soil accelerates the decay of organic matter for the use of the roots.

"Again, it will be admitted that the conditions sought to be obtained by draining are found in greater degree at the surface of the ground than at a depth of two feet; yet it is well known that a post rots off at the surface, leaving the lower end comparatively sound. A practical ditcher informs me that it is common in cutting through wet land, though long since cleared of timber, to find even small roots and bark entirely sound; and my own experience has uniformly confirmed his statement. I have also noticed that on a sandy, porous soil, with perfect natural drainage, posts have to be replaced oftener than on any other part of the farm. Indeed, I might multiply facts, all seeming to teach that the more solid and wet the soil the better it is for holding posts; that the conditions favourable to the growth of plants are also promotive of the decay of vegetable matter, and that the one disadvantage of drainage is that it lessens the durability of our fences. "JAMES ALLINSON.

"Mercer County, N J."

Our correspondent is right in his general principles, but it is important that they be properly applied. The worst condition that a post can be placed in, is where it is alternately subjected to water-soaking and drying. Some fine sandy soils afford just such unfavourable conditions, and it rots; other soils of coarse sand or gravel, which have a bottom drainage, allow the water to pass down freely, so that the posts are never soaked, and remain perpetually dry. These will obviously last a long time. Holes filled with cobble stones, as mentioned by our correspondent, if not drained at bottom, would subject the posts to speedy decay, by soaking them with water at every heavy rain; if well drained, they will be always dry inside. The bottoms of posts which have been set in clayey ground, and the earth solidly beaten as the hole is filled, will be excluded from the air and remain sound; but the trouble is that the portion near the surface is repeatedly wet and dried, and decays rapidly. If the posts could be kept perpetually under water they would last indefinitely, but this can occur only in rare instances. The forester should exercise judgment in the proper application of the above mentioned principles, according to the nature of the case, and the character and condition of the ground.—EDS. *Country Gentleman.*

The Orange Trees at Versailles.—The following fact will serve to give an idea of the longevity of orange trees. The magnificent tree, so much admired in the orangery of the palace at Versailles, and which is known under the name of Grand Constable, Francis I., and Grand Bourbon, is more than four hundred years old. It sprang from some orange pips, sown in a pot at the commencement of the fifteenth century by Eleanora of Castille, wife of Charles III., King of Navarre. The offshoots from this plant were preserved at Pampeluna till 1684, when they were transferred to Versailles. The Grand Constable, which may be regarded as the ancestor of all the orange trees, is still very healthy, and does not appear to suffer at all from the attacks of old age.

Golden Elder.—This is, without exception, the best golden yellow deciduous shrub in existence. Its colour during spring and early summer is as deep and rich as a stove croton. It may be propagated as easily as the common elder, will thrive in any soil, is thoroughly hardy, and does not burn during excessively hot sunny weather, like many other golden variegated plants. For giving effect in ornamental woods or pleasure-grounds amongst hollies, yews, firs, or other dark-foliaged trees and shrubs it is most valuable, and is without an equal amongst golden foliaged, hardy, and rapid growing shrubs.—G. B.

A plantation on the estate of Tulloch was recently disposed of, and the sum realized was equal to a rent of £2 per acre for each of the forty years the wood occupied the ground.

New Parks—*Falmouth.*—The presentation of a public park to the inhabitants of Falmouth by the Earl of Kimberley was recently celebrated with great enthusiasm. The park is situated in the Trevethan Valley, at the top of Berkeley Vale, and its extent is about seven acres. Much of the land required good drainage to get rid of its marshy character, the water being now utilized in forming a couple of ornamental ponds. The many fine elms interspersed over the park are a judicious selection from a number of trees which stood along the old hedgerows, by which the land was formerly divided into small meadows; and they now give a bold and finished character to the scenery. The ground is gently undulating, with the walks laid out in sweeping lines, and, though ten feet wide, they are so arranged that before many years they will probably be nearly hidden from view by luxuriant foliage. The park is eminently picturesque. There are many pretty peeps of broad green sward, miniature lakes, and pretty trees and shrubs, while attractive glimpses of the harbour are obtained from the higher part of the park. In planting the grounds there has been considerable grouping of species—an arrangement which, by and by, will have a capital effect. A group of birch trees will be found in one place, in another elm, in a third planes, Lombardy poplars, silver

poplars, &c., being treated in a similar manner. Among the shrubs are many plants of sub-tropical origin, very choice and in rich variety, and plainly-printed labels help the visitor to call them by their proper names.

Paisley.—On the 26th May a new public park—a gift to the town by a deceased citizen, Mr. Robert Brodie, accountant—was opened with much ceremony. The park is situated at High Carriage-hill, in the southern part of the town, and extends to about twenty-two acres. Its value is estimated at £16,000, and during the past year or two the Town Council have expended about £2,800 in laying it out and ornamenting it.

Gateshead.—Since the grounds of Mr. William Wailes, at Saltwell, were purchased by the Gateshead Corporation and converted into a park for the use of the inhabitants, who, at that time, had little or no place approaching to a recreation ground, great improvements have been made by way of further beautifying the estate. For some time past the park committee have been pushing on the work of improvement with rapidity. One of the chief features will be the long promenade, which is at present under formation at the north end of the park. On either side of the promenade the ground has been laid out under the direction of Mr. Heath, of London, landscape gardener.

The Trees in Sackville Street, Dublin.—Some people inform us that these trees are growing, but we have failed to see whether it is upwards or downwards, healthy or rotten. They are plane trees, we believe—very plain trees, and not likely to make much noise in the wind or the world. They have a habit when they cast their leaves in autumn to be in doubt about the necessity of renewing them, thinking it scarcely worth their while to look green again.—*Irish Builder.*

Weeping Beech.—There is an extremely handsome specimen of the weeping beech growing at Meynell Langley, Derby. It is about seventy years of age, in luxuriant health, with a trunk at 4 feet from the ground 8 feet 10 inches in circumference. The diameter of the branches from north to south is 90 feet, and from east to west 74 feet, giving a circumference of about 240 feet. Can any one say where there is a finer specimen of the weeping beech in Britain?

Erratum.—The paragraph at the top of page 94 of our last number, beginning "The price of underwood," &c., should read,—The price of underwood reached its climax in the winter of 1873, from which date it has fallen considerably in value; owing chiefly to the increased cost of labour for cutting and conversion, the above mentioned prices were, however, obtained during the past season.

Estate Improvements how best Effected.—Although money can readily be obtained from the Lands' Improvement Companies for effecting any improvement of a permanent character at a rate of interest which pays off the debt within a period of from twenty-five to thirty years, still some part of this payment must be drawn from the yearly income of the landlord; hence the difficulty of obtaining his assent. Taking the period of redemption at twenty-five years, the rate of interest will be 6¾ per cent.; under ordinary circumstances, we consider that 3 per cent. on building, and 6 per cent. on drainage, is as much as any yearly tenant can pay. If equal sums were expended on each, it would entail a charge of 2¼ per cent. on the owner. Suppose the owner of an estate of £15,000 a year to spend £20,000 on estate improvements, the charge on the landlord would only be £450 a year—a sum which, on an

state of this value, where the buildings are old and dilapidated, would be insufficient to pay the cost of the necessary repairs; hence in the end it would be a gain to the landlord, increase the production of food, and add to the wealth of the nation.—*English Land Tenure.*

Sale of Estates.—Cullaby Estate, in Northumberland, containing 4,000 acres, has been sold to Major Brown, of Doxford, for £140,000. Recently Sir George Campbell's estate of Edenwood, Fifeshire, was exposed for sale in Dowell's room, Edinburgh at the upset price of £15,000, and was purchased for Mr. Alexander Macdonald, Balranald, at £16,000.

Lord Ilchester's grounds at Abbotsbury, Dorsetshire, we are informed, are now gay with a wonderful display of flowering shrubs, of which there is a great collection. There is also a swannery consisting of 1,200 old swans and 700 cygnets. The place is beautifully situated in a lovely valley near the sea, and well sheltered by bold surrounding heights.

Alleged Improper Cultivation.—Some months ago it was reported that Mr. Marshall, proprietor of Flemington, Inverness-shire, had taken the extraordinary step of incarcerating his tenant, Mr. Alexander Hendry, for an alleged failure to manage and cultivate his farm according to the rules of good husbandry. On the application of the tenant, the Lord Ordinary (Ormidale) granted warrant for immediate liberation, and found that the landlord was not justified in the course he had taken. The proprietor appealed to the First Division, but their lordships have adhered to the Lord Ordinary's decision, with costs.

A "Golden Bough."—In the gardens of New College, Oxford, there is a fine avenue of horse chestnut trees, most of which have had some of their lower limbs lopped off, followed by the usual crop of abundant smaller shoots around the original bough. In one tree, however, with respect to one severed branch, these resultant shoots bear, year after year, not green but pale yellow leaves, the summer through—"Primo avulso non deficit alter aureus, et sinili frondescit virga metallo." It would be interesting to know of other instances of such a veritable "golden bough," and whether any explanation can be given of chlorophyll so remarkably failing to develop its blue-green constituent under no obviously peculiar circumstances. It seems a strange anomaly to find an apparent case of host and saprophyte in one.—*Henry T. Wharton in "Nature."*

Age for Cutting Forest Trees.—An English official report furnishes some general rules for fixing on the proper age for cutting timber trees. Much depends on the uses to which the wood is to be applied. Taking the greatest age given, as one extreme, and the youngest for which timber is used in this country, as the other, we have ages all the way from one hundred years down to eight or ten. For purposes of fuel, where the experiment has been carefully made in this country, it has been found most profitable to cut all off at intervals of eighteen years, and varying according to soil and kind of trees to twenty-five years. In some places it might be more profitable to cut young, densely growing trees of certain kinds for hop poles, at a much less period. In the report we have alluded to, much greater ages are mostly recommended, the wood being used for valuable purposes in manufactured articles. The ash, it is stated, may be profitably cut from thirty to forty years, to be used in the

manufacture of agricultural implements. The Scotch fir, larch and spruce are most advantageously cut at from twenty to thirty years, although in some localities a much higher price may be obtained for certain special purposes at a greater age. None of these would be likely to pay, if grown long distances from market, railway stations or seaports. Elm should never be cut except for large timber, or at an age of 80 or 100 years. The linden is of little value before 60 years. Sycamore should be about 100, as well as chestnut. The oak is of slow growth when young, but grows faster after 30 years. It is extensively used for agricultural implements, furniture, boat and ship building, &c., and should be allowed to grow till it has matured plenty of heart wood, which should not be less than about 100 years old. As already stated, wood which is used exclusively for the manufacture of charcoal, would yield a larger amount, during a series of years, by close planting and more frequent cutting, the second growth springing up and taking the place of the first.—*Country Gentleman.*

Valuable specimen trees which may have been girdled by accident, or by vermin, may be saved by the following method recommended by the *Albany Cultivator*. Draw away the earth below, so as to allow the tool to point upwards, and then, with a narrow chisel, make one cut in the tree near the edges of the bark above and below. Sharpen to a wedge form a small branch half an inch in diameter, and insert the ends into the two cuts made by the chisel. Bind the shoots to their places firmly with bass, and cover the wound with grafting wax. Four such shoots will make a strong connection, and the growth will be scarcely checked. If well done every tree will live, with scarcely the possibility of failure. We have seen a thousand young trees thus saved, on a single estate. The trees are growing as vigorously as any, and have now grown so large as to form one stem, swollen in appearance at bottom. If there happen to be suckers to the trees, these may be used to make the connection.

Eucalyptus globulus.—In the year 1860, Mr. James S. Stratton, Alameda County, California, had his attention first attracted towards the cultivation of forest trees by observing the rapid growth of the Eucalyptus globulus, or blue gum tree, growing on his place at Oakland, in the said County, and in April of that year he secured all the seed he could from these trees, and immediately planted them in a nursery. From these seeds he succeeded in raising about 40,000 young trees, about 30,000 of which he planted in November and December of that year, in a permanent plantation, eight feet apart each way, covering in all about fifty-four acres. These were of the variety *Eucalyptus globulus* or blue-gum of Tasmania, and three years after planting were generally from thirty-five to forty feet high and from five to nine inches in diameter, two feet from the ground. In the spring of 1872 he planted about 50,000 more young trees, covering about sixty acres of ground, and choosing for this planting a high hill, the soil of which was quite sandy, and classed by farmers in the neighbourhood as about the poorest soil in the vicinity. A certain and complete failure was predicted with these trees, but the result has shown that Mr. Stratton acted wisely, as the trees are making almost as rapid growth as those of the first planting, which were nourished in rich valley land. At the age of about two years these trees were from twelve to twenty-five feet high and from two to four inches in diameter. Since the first planting Mr. Stratton has added about 20,000 more trees of various varieties to his hill plantation, blue-gum, red-gum, iron bark, stringy bark, &c., all of which are doing well and look as healthy and vigorous as if they were growing on their native Australian hills.

Again, in the spring of 1873, about 30,000 more trees of different varieties of *Eucalyptus* were added to the two plantations, making in all about 135,000 trees, and covering an area of about 170 acres. Mr. Stratton commenced his enterprise for the purpose of growing wood for fuel alone, not dreaming that a tree of such rapid growth as the *Eucalyptus* would prove valuable as a timber tree; but experiments recently made demonstrate that it will successfully compete with any of the imported hardwoods, hickory alone excepted. An inch-square stick of blue-gum taken from the sap, suspended horizontally on supports two feet six inches apart, sustained, at the centre 260 pounds, without breaking, being bent by that weight only one inch, showing a strength equal to the average of imported ash. Its specific gravity is 680, that of eastern ash and maple, about 750.

Pines on the Alps, and in South Germany.—The northern slopes of the Alps and the secondary mountains in the south of Germany abound in pines, and the mode of conveying timber on the Rhine in great rafts is worth recording. A little below Andernach the Rhine forms a little bay where the pilots are accustomed to unite together the small rafts of timber floated down the tributary rivers into the Rhine, and to construct enormous floats, which are navigated to Dortrecht and sold. These machines have the appearance of a floating village, composed of twelve or fifteen little wooden huts on a large platform of oak and deal timber. They are frequently from 800 to 900 feet long, and from 60 to 70 feet in breadth. The rowers and workmen sometimes to 700 or 800, superintended by pilots and a proprietor, whose habitation is superior in size and elegance to the rest. The raft is composed of several layers of trees placed one on the other and tied together. A raft draws not less than from six to seven feet of water. Several smaller ones are attached to it, by way of protection, besides a string of boats loaded with anchors and cables, and used for the purpose of sounding the river and going on shore. The domestic economy cannot be more complete; poultry, pigs, and other animals are to be found on board. The dinner hour is announced by a basket stuck on a pole, at which signal, the pilot gives the word of command, and the workmen run from all quarters to receive their messes. These rafts are not of modern invention, and are not confined to Europe. Evelyn, on the authority of Le Compte, says that the timber merchants of China transport immense trees or floats, upon which they construct huts or little cottages, where they live.

Scandinavian Pines.—The summit of the mountains of the Gulf of Bothnia may be taken as the limit of the Scandinavian pines, as from thence to North Cape there is nothing to be met with but dwarf birch. The principal rivers by which these pines are brought to the seaboard for the purposes of commerce, are the Gotha in Sweden, and the Glommen in Norway. The Gotha issues from the large lakes of Wener in the centre of the southern part of Sweden; and the lake receives many streams from the mountains, some of which are of great length and pass through forests of the finest pine.

We are pleased to see by the announcement in the *London Gazette* that Dr. Hooker, C.B., Director of the Royal Gardens, Kew, has been appointed a Knight Commander of the order of the Star of India. We congratulate Sir Joseph Hooker on this well-merited distinction.

Rendering Fence Posts Durable.—A mixture of charcoal and linseed oil as recommended by some, will not enter the posts to any extent, and in the absence of information as to its tried value, the preparation appears to be that of a mere theorist. The common mode of soaking the portion which enters

the ground in hot gas tar is obviously much cheaper and more efficient. Heat the tar in a large stove boiler or kettle to a temperature that will be safe from taking fire, and then immerse as much of the posts as are to be buried for a few minutes, when the tar will enter the exterior portion of the pores of the wood, and when dry will form a coating outside impervious to water. The posts should be well seasoned previously, and the tar should not come much above the surface, as it does not help the durability of wood when much exposed to the changes of the weather. A still better way is first to soak the posts in crude petroleum, which enters the pores to a much greater depth, and then coat them with gas tar as before, which will hold the petroleum. This treatment may be given to any kind of wood; the more durable, the less obvious will be its preservative effect. The importance of giving a good bottom drainage to posts is not sufficiently understood. If they never become water-soaked, but are always dry internally, they will obviously last many times longer than when repeatedly made wet and dry. Hence the importance of placing the fence near or over a good underdrain.—*Albany Cultivator.*

Madagascar.—The Rev. T. Brockway, travelling in Madagascar, alludes to the vegetation as follows: "It was not yet the season for flowers, but there were some here in warm spots. Sometimes I saw orchids hanging from trunks of trees, and found one beautiful specimen of a terrestrial orchid in full bloom, and in a sheltered nook recognized the pretty blue lobelia. Ferns of great beauty abound, among which the tree fern and the maidenhair are frequently seen. But it was almost worth the trouble of the journey to see the bamboos. These with the roffia tree and the traveller's tree, only found in hot regions, showed the luxuriance of vegetation in this tropical climate."

Paraffin Oil.—The value of paraffin oil as a preventative remedy for insects injurious to farm, garden, and forest crops has been engaging some little attention of late, and Young's Paraffin Light and Oil Company have recently issued a circular in reference thereto. It is stated by the company, in their circular, that "experiments have shown that this oil can be applied so as to produce no injurious effects on the seeds and plants, while, at the same time it is so obnoxious to animal life as to greatly lessen, if not altogether to prevent, those destructive inroads which every farmer, gardener, and forester has to deplore." Directions for the use of paraffin oil are given as follows "Add a wine-glassful of paraffin oil to a thirty-gallon cask of water, agitate thoroughly, allow the mixture to settle, skim off the oil that rises to the surface, and employ the water—1, for soaking the seeds before use; 2, for sprinkling the ground between the rows or drills after the plants have brairded. Care should be taken to avoid sprinkling the plants." As the cost is infinitesimal; the suggested remedy is well worthy of a careful trial.

Carbolic Acid for Insects.—A writer in the *Gardener's Monthly* gives his experience in the use of carbolic acid for destroying all sorts of insects and lice which infect trees, plants, &c. If possible obtain the crude acid, because it is stronger and better in this form. First make a good strong suds of domestic soft soap, and into this pour a quantity of the acid and let it remain a few hours. Then test it by mixing a little with soft water. If too much acid has been used oily particles will float on the surface; in which case use more soap, until the same will balance the excess of acid. No more definite rule can be given, and a little practice will enable one to compound it correctly. Apply with a sponge or syringe. Generally it will not injure the foliage of the most delicate house plants. [We should nevertheless warn our readers to be cautious in experimenting with such a deleterious mixture, and to thoroughly test its

effects on plants of little value, before applying it to valuable specimens.—Ed. *J. F.*]

Obituary.—We regret to announce the death, on May 23rd, of Mr. James Barnes, late gardener, forester, and land-steward at Bicton, Devonshire. Mr. Barnes, besides being a distinguished horticulturist and able writer on gardening matters, was also an eminent arboriculturist, and the celebrated collection of coniferæ, and other rare and ornamental trees and shrubs at Bicton, were chiefly formed under his practical superintendence, and are a living tribute to his good taste and eminent ability. We also regret to announce the death of Mr. Henry Merryweather, which occurred at the Nurseries, Southwell, Notts, on the 17th May. Mr. Merryweather was a man of great experience, and he was held in much esteem in the neighbourhood. Mr. Merryweather was seventy-four years of age, and is succeeded in the business by his son, the eminent rosarian. We also have to record the death, on May 1, at Wimbledon, of John Russell Reeves, F.R.S., F.L.S., of Woodhayes, Wimbledon, and Huntsland, Sussex, formerly in the H.E.I.C.S. in China, aged seventy-three. Mr. Reeves, when in China, was the means of introducing several fine plants to this country, some of which, such as Reevsia thyrsoidea and Spiræ Reevsii, bear testimony by their names to the good service he rendered to botany, horticulture, and arboriculture.

Foreign Woods.—Seventeen foreign countries made excellent displays of forest products at the great Centennial Exhibition at Philadelphia, U.S.A. last season, but of special interest and value were those from Brazil, Argentine Republic, Phillippine Islands, Canada, and Japan. Brazil exhibited 210 varieties of ornamental woods in sections of about five feet in length, and partially dressed. The Argentine Republic presented 300 varieties, and other countries lesser numbers, those from Japan being prepared to present planes at different angles, showing thoroughly the cellular structure, the sections of each species being accompanied by specimens of leaves, branches, flowers and seed vessels, and all scientifically named. Venezuela displayed over 200 medicinal products of the forest, and 100 varieties of woods.

A Good Custom.—We have been asked if it is true that in Switzerland the law compels every newly-married couple to plant six trees immediately after the marriage ceremony, and two on the birth of each child? We cannot answer the question, and refer it to our Swiss correspondents for solution. In the meantime we doubt the veracity of the report.

A Jubilee.—We learn that it has been proposed amongst the numerous friends of Mr. Robert Foulis, gardener and forester to George W. M. Henderson Esq., at Fordell, Fifeshire, to present him with a testimonial to commemorate the completion in September next of a service of fifty years at Fordell. A strong committee for the management of it has already been formed, with its head quarters in Edinburgh, and from the high esteem in which Mr. Foulis is held throughout the country, we have no doubt the movement will meet with a hearty reception and a well deserved success. We are glad to know that Mr. Foulis, although considerably over three-score years and ten, is still hale and hearty, and actively superintending the gardens and woods at Fordell, with an amount of energy and ability, and a thorough knowledge of the best systems of the day in vogue, in horticulture and aboriculture, that would put to shame many men in the prime of life. Long may he be spared in health to enjoy the esteem of his friends, and to fill the position he has so long and honourably held.

FROM a circular issued on the 12th of last June, by the Governor of the State of Connecticut, we learn that the Hon. B. G. Northrop, of the Board of Education of that State, has been commissioned by the said board to visit the Schools of Forestry, Forests, and Plantations, and other schools of rural industry in Europe, to examine into their various modes of teaching and working, and afterwards to report the results of his observations for the benefit of the schools and people of the State, so as to instruct them in the best methods followed in Europe, and adapted to their wants; and more especially to encourage the reclamation of waste lands by the propagation and planting of trees. In sketching out the work before him during his visit to Europe, Mr. Northrop says :—" One object of this trip is to gather facts from a wide field of observations which may further the work of rural adornment and village improvement, so well inaugurated in the State of Connecticut. The interest awakened in our State in tree planting has been limited mostly to fruit and ornamental trees. My special aim will now be to encourage the planting of timber trees, and to help reclaim sterile or exhausted lands by tree planting. The experiment of thus reclaiming barren lands in Scotland, France, Germany, Austria, and other European countries, has been tried on a large scale and with great success. The economic bearings of forest-culture are too little appreciated in America. In this respect Europe can teach us a much-needed lesson."

Mr. Northrop brings excellent credentials from Governor Richard D. Hubbard, who commends him to the courtesies and co-operation of the managers of the institutions above named, and to all others who are interested therein, more especially those who have it in their power to promote the furtherance of the objects of his visit. We know that British foresters will not fail to uphold the courtesies and

hospitality of our country should Mr. Northrop pay us a visit, and will do their best to make his stay amongst us as pleasant to himself and as profitable to his enterprising State as it is possible for private individuals to do, since our Government is an age behind other European States in the provision it makes for the entertainment and enlightenment of such distinguished delegates, who may come from other countries to observe and inquire into the economic principles and practical working of our rural industries, more particularly in the important branch of Forestry, which up to the present day is totally neglected by the British Government. Such a deplorable and unsatisfactory state of matters will not, we hope, be allowed to remain much longer as a reproach against us.

It is highly encouraging to see the laudable endeavours which this State of Connecticut is now making to rectify the ruthless waste in former times of its noble forests, and to rehabilitate the face of the country with a verdant mantle of waving woods, ameliorating the wintry blast, and affording grateful shade from the scorching heat of an American summer. In the neighbouring State of Massachusetts very liberal prizes are being offered for tree planting, with a view to stimulating this important branch of rural industry. Three prizes of 1,000, 600, and 400 dollars, or about £250, £150, and £100, are offered for the best plantations of larch, or Scots fir, where it is found more suitable; each competing plantation to consist of not less than five acres, and to have been originally planted with not less than 2,700 trees to the acre. To qualify a plantation for competing it is also stipulated that it must be made on poor, worn-out land, or land which is otherwise unfit for agricultural purposes; a wise provision in a case of this nature. There are also prizes of about £150 and £100 offered on the same conditions, only that they must contain at first planting not less than 5,000 trees per acre, for plantations of American white ash. The competing plantations were to be made this season, and must be open at all times to a committee appointed for their inspection, and who will award the prizes during the too distant summer of 1877. A pamphlet of valuable instructions and suggestions on tree planting, by Professor Sargent, director of the Botanic Garden and Arboretum of Harvard University, is published by the State Board of Agriculture, for the information of those who contemplate planting, so that they can scarcely fail in making it both a pleasure and a very profitable investment of their capital.

THE clearing of land from big boulders and rock, and the grubbing out and bursting up of large tree roots, are two of the most laborious and expensive operations connected with forestry and estate man-

agement, and any invention which tends to lessen the labour and cost of such operations deserves the careful attention of all who are interested in their management. We would draw the attention of landed proprietors, estate managers, foresters, and others, to the following very promising and interesting experiments made upon a variety of objects, in a field at Farnley Wood, Yorkshire, by Mr. T. Dineen, of the firm of Dineen, Son, and Co., Leeds, with their new explosive, known by the name of "TONITE." The experiments were undertaken at the request and in the presence of a number of gentlemen connected with the management of landed property, iron-works, iron mines, coal-pits, quarries, &c., in the neighbourhood, and carried out in a highly satisfactory and successful manner, under Mr. Dineen's personal superintendence. The object was to show how the explosive could be used in clearing land of tree stumps and boulder stones, as well as in quarries and iron-works, in breaking up slag, old iron, &c., and to prove its perfect safety in handling, transit, storage, and use. The "tonite," or "patent cotton gunpowder," is of a very different nature from dynamite or gun-cotton, and Mr. Dineen claims for it that it will not explode except when a cap or detonator specially provided for it is inserted in a cartridge with a lighted fuse attached. It then explodes with a loud report, but produces no smell, smoke, or poisonous fumes. It contains no nitro-glycerine nor dangerous compounds of any kind, and has no means of igniting within itself. To prove the safety and strength of the powder, Mr. Dineen cut a cartridge in two pieces. On one portion he poured nitric acid and sulphuric acid, to show that acid would not burn it. With a match he then lighted the portion of the cartridge which he held in his hand, and threw it into a small pool of water, the result being that the flame was at once extinguished. To show the effect when the proper cap and fuse were attached, he took a cartridge, and having lighted the fuse, threw it into the pool. The spectators retired a short distance, and soon a loud explosion occurred, and the water was sent to a great height. To prove that concussion in transit would not cause the tonite to explode, Mr. Dineen placed a cartridge on a brick and struck it a blow with another brick. He next placed the cartridge on a stone with a fuse attached, and covered it with a small quantity of clay. On being fired the stone was broken into fragments, thus showing the downward power of the explosive. Another proof of the safety of the tonite when no cap and fuse are attached was given by Mr. Dineen, who put one pound of gunpowder over a cartridge. On being fired the gunpowder exploded, but the only effect upon the tonite was to ignite it. Cartridges were also placed under the stumps of trees, and these were shivered into fragments. Seven cartridges were then placed beneath a stone which weighed between

two and three tons, and the result of the explosion was to break the stone into a great many small pieces. Another large stone was fired from the top, with only a little clay over the cartridge, and the result was the same. A piece of an iron rail was then brought forward. It was 2 ft. by 4 in. by 2 in., and weighed 36 lbs. A cartridge having been placed beside it and fired, the rail was broke into four large pieces, in addition to many smaller ones. At the close of the experiments, when many people had left the ground, Mr. Robertshaw, chief manager, Farnley Iron-works, and Mr. Tempest, manager for the Lowmoor Iron-works Company at Beeston, expressed a desire to have the tonite tried on a piece of rail made from the best Yorkshire iron manufactured at the Farnley Works. Accordingly a piece of rail was brought which measured 6 ft. by 4 in. by 2 in. In the first shot three cartridges were applied, and on being fired the rail was completely fractured. A single cartridge was then applied to one of the broken pieces, measuring 2 ft. 6 in. in length, and the result was that the rail was completely splintered and scattered. The gentlemen present expressed themselves entirely satisfied with the experiments, and there appears to be little reason to doubt that tonite is one of the simplest, safest, and most powerful of explosives which have yet been brought before the notice of the public, and if it can be produced in quantity at a moderate cost, it will prove to be one of the greatest boons of recent introduction to landowners and others, who at present find it a costly process to reclaim stony land, and to remove large old tree roots.

The Economics of Forestry.

By G. S. BOULGER, F.L.S., F.G.S., Late Professor of Natural History in the Agricultural College, Cirencester.

"The greatest happiness of the greatest number" is both practically and theoretically taken as the object of collective human endeavours. To attain this object is, therefore, the practical end in view in the investigations of the science of wealth—plutology, or economics. Wealth, welfare, and the common weal are closely related—nay, identical—etymologically, and no less closely related in reality.

The fundamental maxim of exchange is "to buy in the cheapest market and to sell in the dearest," but an even more fundamental maxim of a truly cosmopolitan science of economics would be "to utilize to the full the powers of nature," that is "to produce as cheaply as possible," and, therefore, "to produce the right thing in the right place."

No one thinks now-a-days of starting a coal mine far from rail or other means of communication with the market, as they would be undersold, yet there is still talk about home-grown this, that, and the other, the patriotism of using inferior or dearer articles, or to encourage home productions, and so on. This is surely contrary to common sense. Let us hear, on the other hand, what that clear-sighted economist, the late John Stuart Mill, has to say on the subject.

"The benefit of international exchange, or, in other words, of foreign commerce, consists in a more efficient employment of the productive forces of the world. . . The produce of the whole world would be greater or the labour less than it is if everything were produced where there is the greatest absolute facility for its production. . . If capital removed to remote parts of the world as readily and for as small an inducement as it moves to another quarter of the same town, . . profits would be alike or equivalent all over the world, and all things would be produced in the places where the same labour and capital would produce them in greatest quantity and of best quality. A tendency may even now be observed towards such a state of things; capital is becoming more and more cosmopolitan; there is so much greater similarity of manners and institutions than formerly, and so much less alienation of feeling among the more

civilized countries, that both population and capital now move from one of those countries to another on much less temptation than heretofore."—"*Political Economy*," Book iii., chap. xvii.

To apply these general principles to forestry, we must look upon it as an art not merely designed to afford pleasure but to afford profit, as an art based on science, the practical application of the principles of the physical sciences which subserve the science of economics. Forestry is the art of producing or growing timber. It is based on the general principles and scattered observations of science, its main object being a remunerative crop. As we cannot assess the value of pleasurable feelings, we cannot reduce the landscape gardening aspect of forestry—useful as it may be—to scientific principles. It is purely subjective, a matter of taste. Scientific forestry, on the other hand, is the growing the right tree in the right place. This is a purely objective matter, a matter of fact. The right place must be in the most suitable climate and soil, with the right amount of room or shelter, and last, but not least, in proximity to a market for the produce.

South of the Thames we can be said to have little or no systematic forestry, though there is abundance of waste land yielding no produce or rental, much of which is obviously well suited to the growth of timber. We have seen farmers from Norfolk utterly disgusted at the tree-surrounded corn-fields of Surrey. The trees here are merely ornamental; but in the north-west and west of the same county, and in the adjoining parts of Berkshire, are vast tracts of nearly treeless moor. These wastes are on the Bagshot sand formation, and will sustain but a very short, stunted growth of grass. With manure, potatoes may succeed; but without it, birch, conifers, and heather seem to be its sole products. The admirably pervious character of the soil has pointed it out as healthy for public institutions and cemeteries. Unenclosed young firs are nibbled down by cattle or smothered by heather, while strangely, as it seems to us, what planting has been done is entirely of Scotch fir, instead of the more suitable and probably more valuable larch, or a mixture. What inducement is there then to plant such waste lands with trees, or similarly to plant our chalk hills with beech and Scotch fir? In answer to this it may be sufficient to quote "Brown's Forester," only premising that his arguments err rather in proving more than is required for his case or ours.

"Land under wood will," he says, "at the end of sixty years, under good management, pay the proprietor nearly three times the sum that he would have received from any other crop upon the same piece of ground." He then instances an estate at Craigston, in Aberdeenshire, where land capable of yielding a yearly agricultural rent of ten shillings was planted with larch, Scotch and spruce fir, 4,000 to the

acre, at a cost for trenching and planting of £11 per acre, and thinned at 14, 20, 28, 35, and 45 years, the last 180 trees being felled at 60. He reckons the total cost at £44 15s. an acre, and the value of the 2,580 trees sold, after the failure of 1,400 from bad management, at £189 11s. 8d., making a net profit of £144 16s. 8d. per acre. He further adds that good management would produce half as much again at each stage; but this may reasonably be doubted, whilst the large preliminary outlay or tying up of capital necessary in tree-planting must also be taken into account as opposed to the quick returns of agricultural rent. Time is money now-a-days, and there is such a thing as compound interest for annual ten shillings; so that it would seem better that we should only claim as the economic maxim of our science, that a tardy, but safe, and by no means despicable return to capital from land is better than none at all. There may be little arable land in the south of England which it would pay to convert into forest, but it certainly would pay so to treat our waste.

It is of course economically indispensable that the tree should be grown not only in the right place but also in the right manner. In a successful forest no tree should remain after it has reached maturity, and it is further necessary that the produce should be sustained, *i. e.*, that the trees should be systematically replaced as they are felled.

The treatment of a forest is then a function of three variables, the climate, the soil, and the nature of the trees to be grown. Forestry, therefore, depends largely upon meteorology, vegetable physiology, and the unnamed science of soils. It may appear strange that climate —taken in a broad sense—should stand first; but it must be remembered that by far the greater part of the bulk of our forest trees is made up of the water they derive from the rain and the carbon derived from the air.

In conclusion it must be stated that this attempt to set forth the basis of the science of forestry and its economic relations has been written not so much for the forester as for the outside world, who recognise but little of the importance of the subject.

Hints for Laying out Suburban Villa Grounds, and Notes on the most Suitable Trees and Shrubs.

HOLDING as I do that no suburban residence, say with an acre or even less of pleasure-ground around it, can be considered complete without several of the rarer *Coniferæ* for its embellishment, if not for shelter, I willingly offer my views as to the varieties to be planted, their arrangement and mode of treatment, in order to produce what I conceive to be the best results for effect as well as for *shelter*, the latter being an object never to be overlooked where there is no outside screen save a boundary wall.

But first let me premise as to the form of the ground proposed to be laid out. Suppose, then, a villa residence, embracing with its surroundings about an acre of ground, either square or in the form of a parallelogram, surrounded by stone walls seven feet high, which it is not thought desirable should be clothed with fruit-trees, which would not only be out of place, but would frequently be a source of annoyance arising from the necessity of protecting the fruit; and suppose that the mansion with its small court of offices (consisting probably of stable, coach-house, coal-house, wash-house, and wine-cellar, forming an enclosed square), is set down in the centre, the carriage way will enter at one extremity, or at both extremities, where there may be lodges if the extent of ground admits. Then first, if it is wished to have two gates, bring up the carriage way by a serpentine curve towards the main door of the mansion, and continue it on by a like curve to the other gate, where there may be another lodge, and the two lodges would thus be available for the accommodation of both a gardener and a groom. If, however, only one gate for entrance is desired, then the roadway may be carried by a curve to the main door, thence back, sweeping round a centre plot in front, which, verged with grass and planted with roses, is very effective. The next operation is to lay out the gravel walks; these should be five feet wide, the carriage-way being ten feet. In laying these down the owner may consult his own taste; but it may be suggested that, unless where conservatories or vineries compel the use of them, straight lines should be avoided. Let the main surrounding walk follow a serpentine sweep, cutting off the four

corners or angles of the ground by deeper curves, and never allow the walk to come nearer the outside wall than four feet, nor be farther distant from it than eight feet, unless at the angles of the ground, where the curve at its centre may be twelve feet. This may be carried all round the grounds; and where cross walks are required, these should also be laid down in curved lines, unless where compelled to run in straight lines by buildings, &c. The effect is good where the average breadth of border next a wall is not more than six feet; and in a word, let straight lines be avoided wherever possible.

Then, as for the trees and shrubs to be planted, we cannot too strongly recommend that *evergreens* be adopted, and all deciduous, things be avoided as much as possible.

For the surrounding screen within the boundary wall the fastest growing coniferous trees should be selected, getting them for speedier effect as large as can with safety be transplanted. For this purpose take *Cupressus macrocarpa, C. Lambertiana, C. Lawsonii, C. fragrans, Thujopsis borealis, Thuja gigantea, T. occidentalis,* and *Biota orientalis.* And among these at intervals may be gracefully introduced *Cedrus Atlantica* (a hardier, handsomer, and much better grower than *C deodara*), *Abies Douglasii, Pinus cembra, P. Austriaca,* or any other of the hardier pines to suit the fancy. To fill up interstices in front next the walk, the various species of Arbutus may be used, such as *Arbutus andrachne, A. Menziesii, A. procera,* and *A. Croomi;* a few evergreen barberries and laurels, of which there are many new sorts finer and hardier than the common laurel. The commoner species of rhododendrons, aucubas, and hydrangeas, peeping out at intervals, tend much to vary, and, when in flower, to enliven the general mass. There might be within the grass verge a border about one foot wide, where numerous hardy border flowers, such as snowdrops, primulas, crocuses, winter aconite, and other early flowering plants might be very effectively introduced. If the walls behind the screen are not utilized for other creepers, train upon them the different varieties of ivies, which, seen through the openings, look well, and are quite in harmony.

It is assumed that, with the exception of sites for a greenhouse, a conservatory either attached to or separated from the mansion, a vinery, and perhaps a house for camellias and tender rhododendrons, the surrounding grounds shall be laid out in grass studded with clumps oval or circular, of the hardier hybrid rhododendrons, which, whether in flower or not, are very effective on the greensward. We shall not attempt to select the varieties; their name is legion. But free flowering kinds of good habit, and of all colours, from pure white to the deepest crimson, can be easily secured, and at moderate prices, from any good nursery collection.

In addition to the shrubs and trees already suggested for the screen, not a few of which, however, are well suited for single specimens, dotted over the open lawn, especially such as *Thuja gigantea*, a very fragrant and elegant species, and of pyramidal habit; *Thujopsis borealis*, the hardiest of all the coniferous family; *Cupressus Lawsonii* in so many shades of colour and habits of growth—all handsome; and *C. fragrans*. Nor should we omit to name the following, viz., *Abies Albertiana*, *A. Alcocquiana*, *A. Douglasii*, *A. Hookeriana*, *A. Parryana*, *A. Pattoniana*, *Cedrus Atlantica*, *Cryptomœria elegans*, and *Cupressus funebris*, which the writer finds with him to be perfectly hardy, though considered by many as tender till it has lost its infantine dress and assumed its permanent foliage. *Juniperus Sinensis*, *J. recurva*, *J. squamata*, *J. excelsa*, *J. drupacea*, *J. rigida*; *Picea grandis*, *P. Lowei*, *P. magnifica*, *P. nobilis*, *P. Nordmanniana*, *P. Numidica*, a new, beautiful, and hardy species from the Algerian mountains; and *P. pinsapo*. The Pines are rather large, but those here named are beautiful and admissible, viz., *Pinus cembra*, *P. Coreaensis*, and *P. Austriaca*. The Retinosporas are indispensable, viz., *R. ericoides*, *R. filicoides*, *R. leptoclada*, *R. obtusa*, *R. pisifera*, *R. plumosa*, and *R. squarrosa*; so also *Sciadopitys verticillata* (the umbrella pine of Japan); *Sequoia sempervirens*, *Thujopsis dolobrata*, both green and variegated varieties; *T. filicoides*, *T. lætevirens*, *T. Standishi*, *Tsuga Sieboldii*, and perhaps one *Wellingtonia gigantea*. *Araucaria imbricata*, though stiff and formal, may be added, as when it attains a height of twenty feet or more it loses this appearance to a great extent, and becomes a very handsome and striking acquisition in any collection.

There are still some evergreens which cannot be dispensed with, and which might be put down according to taste, singly or in clumps, such as aucubas, male and female, in several handsome varieties, and which, when the females are clothed with their bright scarlet berries, are strikingly beautiful. The same can be said of the hollies in both their green and variegated types. The *Osmanthus ilicifolia*, also in green and variegated forms, is very beautiful, and so is *Raphiolepis ovata*, with several sorts of *Hydrangea*, especially *H. alba-rosea* and *H. otaksa*; though these are not always evergreen, they both are quite hardy.

The writer having grown and familiarized himself with every one of the species above suggested, can conscientiously recommend them, and being all, with the exception referred to, as green in winter as in summer, the latter season seems as it were prolonged throughout the year, unless perhaps when frost and snow cover the face of nature with a wintry shroud, while the sense of feeling is betrayed into the like delusion from the warmth and shelter so perfectly maintained by surrounding trees.

Lastly, the delicious perfume which so many of these shrubs exhale is not only grateful to the sense of smell, but is regarded as salubrious in a high degree. Of course we exclude the kitchen-garden in our arrangements, but there is another exception from all being evergreen, and we cannot exclude sufficient space for roses, beds for which should be tastefully arranged opposite the principal windows, and large enough to admit of growing at least 100 to 150 plants of the best and sweetest perfumed varieties. And still, in such a piece of ground as we have contemplated, there ought to be sufficient space available for an ordinary sized rockery. Any one who has travelled abroad, and watched at home the progress made of late years in that department of gardening, and observed the many beauteous Alpine plants that may be reproduced in all the elegance of form and glowing tints of colour in which they are found in their native haunts, enjoys at once the double pleasure which their beauty yields, and the pleasant memories of Alpine heights achieved, which, when seen again, these favourite tiny things recall. I. A. H.

Sale of Timber in Roxburghshire.

On Friday, the 20th July, a large quantity of wood was sold by auction at Wells, on Sir W. Elliot's estate (Rulewater), in Roxburghshire, consisting of larch from 70 feet down to pitwood size, nearly all sound and clean, grown partly in the bark and partly striped ; spruce of fair size ; Scots fir, mostly propwood, with a few trees up to 25 feet (certainly none of the best on the Wells estate, as some of the best fir trees in the south of Scotland are to be found there). The hardwood was not a particularly good lot, with the exception of a few oaks, which were outside trees of crooked growth.

The wood was all cut and laid in lots, near where they grew, of two to six trees in the larger class. Access to the lots was rather difficult, although not far from a road, and between four and five miles from a railway station. Larch of best quality and size brought from 1s. 2d. to 1s. 6d. per foot, others from 10d. to 1s. per foot. Spruce and Scots fir ranged from 2d. to 5d. Oak sold at from 9d. to 1s. 8d. per foot. As is always the way at auction sales, trees of equal quality and size varied very much in price. Two trees, sold separately, lying near each other, were disposed of at the same price—viz., £2 17s. 6d. ; the one contained 50 and the other 60 feet.

The sale was energetically conducted by Mr. A. Oliver, of Oliver and Son, awick. Most of the local buyers, and some from a distance, were present, many of whom remarked on the efficient way in which the trees had been cut and pruned, reflecting much credit on the industrious forester, Mr. Wood.

M. R.

Indian Forest Administration.

By JOHN R. JACKSON, Royal Gardens, Kew.

Under the title of "Reports on the Forest Administration in the several provinces under the Government of India, with a review by the Inspector-General of Forests," has just been issued from the Government printing office at Calcutta, a bulky book, the form and green colour of which are now so familiar to all interested in the conservation of the Indian forests. From Dr. Brandis's "Review," we may obtain a very good idea of the extent and produce of some of the more important and best managed forests. For instance, in the Muraghat forest there are 3,168 acres actually stocked with Sâl (*Shorea robusta*); most of these plants, however, are said to be very young, so that it is calculated that cuttings of mature timber will not be made before 1883. Of the Buxa Sâl forest, the conservator reports that it is one of the best in Bengal, the trees are of a very fine shape, and attain very large dimensions.

In the North-western Provinces, the most important work carried out was at Rani Rhet, where 109 acres were planted out with deodar horse-chestnuts, and walnuts. The difficulty here is said to be "the limited area of suitable land available for the extension of these plantations, which are necessary in order to ensure a permanent supply of timber, fuel, and water for this important military station." With regard to teak (*Tectoriea grandis*) in the Burmese forests, we are told that in the best natural forests this tree is scattered, and consequently the management of such forests will always be difficult. The cultivation of teak, therefore, in suitable localities is necessary to obtain forests with a larger proportion of teak, and therefore easier to manage than the present natural teak forests. The raising of artificial forests of teak, whether pine or mixed, with bamboos and other trees in Burmah, is no longer an experiment; the operations have now been reduced to a regular system, the success of which is certain. What remains to be done is to diminish the cost of the formation and maintenance of these plantations. This is not an easy task to accomplish, for the rate of wages for such work in Burmah is between eight and twelve annas per diem, while in the Punjab it is about one third of that amount. Every acre, however, stocked with teak on suitable soil,

and in accessible places easily worked, will be of very great value hereafter, when the supply of that timber from beyond the frontier will have diminished, and when the forests and plantations of British Burmah will be expected to yield the greater part of the annual outturn which is now brought both from the British forests and from the forests in foreign territory.

A few experimental teak plantations have been started in Assam, but it is not intended to extend them, Assam being entirely outside the area of the natural distribution of the tree. The most important and profitable plant in Assam is the *Ficus elastica*, or East Indian rubber plant. The Report says that "this tree is principally cultivated at Kulsi and at Charduar in the Tezpur district. The Kulsi plantation covered thirty-five acres at the close of the year, and preparations had been made to increase it, but there was no intention to extend it beyond 100 acres, as the climate is considered too dry for the profitable cultivation of *Ficus elastica*. In the Charduar caoutchouc plantation 180 acres were stocked at the close of the year, and this plantation it is intended to extend on a large scale. The system followed by Mr. Mann was to clear lines through the forests twenty feet wide and 100 feet apart, and on these lines to plant the young trees at distances of fifty feet. It was, however, found that the shade and drip from the trees on either side of the line injured the young caoutchouc trees, and accordingly the width of the lines was increased to forty feet. In future it is intended to plant the trees at distances of twenty-five feet, and this will doubtless be a great improvement. Even at that distance each tree occupies an area of 2,500 feet, which allows only seventeen trees per acre. In the Kulsi plantation the lines are fifty feet apart and twenty feet wide, and the trees are planted out at distances of twenty-five feet. The plants are raised from cuttings and from seeds in nurseries, and a quantity of seedlings was also brought in from the hills north of the Charduar plantation. The facts recorded by Mr. Mann leave no doubt that the *Ficus elastica* grows readily in the ground from seed self-sown or planted; experiments have, at the same time, however, been made to plant seedlings in strongly-made cane baskets, and to place them in the forks of trees. Data will thus be gained to determine whether there is any difference in the rate of growth of trees grown in the ground and on the branches of other trees."

These experiments and facts are most interesting and of the greatest value to those interested in the cultivation of the *Ficus elastica* as a rubber-producing tree, for it is well known that in the Indian forests the plants luxuriate among the branches of other trees, clasping and sometimes entirely enveloping the trunks of the trees upon which they have taken possession. It is also well known that

the india-rubber tree can be readily raised from cuttings, but the information we may look for in future reports is whether there is any difference in the rate of growth of plants raised under these opposite conditions.

With regard to teak in Moulmein, we learn that the export of this valuable timber "commenced about 1829, a few years after the annexation of Tenasserim. Until 1835 the whole of the timber exported was brought from the forests in British territory, principally from the Altaran district. From that year commenced the importation of timber from the forests situated in Siam, beyond the British frontier. The quantity annually imported from this source increased steadily, and soon exceeded the quantity brought from the forests in British territory. After the annexation of Pegu, and during the first six years of the existence of a regular forest department in British Burmah from 1856-7 to 1861-2, the forests in British territory yielded an average quantity of 20,191 tons per annum, while the importations from beyond the frontier during the same period were four times that amount." During the last seven years, from 1868-9 to 1874-5, the annual average of British timber brought to Rangoon and Moulmein has been 45,000 tons. Another valuable wood produced in the Indian forests is sandalwood, by far the largest portion of which is produced in Mysore and Coorg. The revenue realized by the sale of sandalwood in Mysore is stated to form considerably more than a half of the entire forest revenue of the province. A small quantity of sandalwood is also obtained in North Kanara and Dharwar, and much larger quantities in the Salem and Coimbatore districts of the Madras Presidency. It is chiefly exported from Bombay, and though the quantity is not exactly known, it is considered not to exceed 400 tons per annum, of the value of about 500 rupees per ton.

Many other products, both of woods, resins, oils, &c., are treated in this Report, or rather series of reports, but we have said enough to show that these accounts of the working of the Indian forests contain much valuable and interesting matter.

Advantage of Home Nurseries to Proprietors.

THE renewing of old plantations and the planting of new ones is a duty which falls to the forester less or more every year; and to secure success, it is highly advantageous that the proprietor should have a home nursery, properly stocked and kept in good order. This is especially necessary if the estate stands at a high altitude, where the ground to be planted is often of the barest and bleakest nature.

It is not my object to dilate on the details of nursery management, as it is presumed that the forester has acquired a practical knowledge of that branch of his business already; and I also pass by such considerations as the advantage of a home nursery for the rearing of plants to a large size for special purposes, or the object of having a stock always on hand to meet emergencies and obviate the necessity of going long distances for small quantities of trees. My chief aim is to point out the utility of a home nursery when planting on upland, barren, and exposed districts; also, how it may be of great practical use in training the young forester to a thorough knowledge of his profession, and imbuing him with correct notions of the proper treatment required by trees even in their primary stages.

The successive advances which cultivation has made on our more outlying districts has driven the modern planter to a higher zone, so that he generally carries on his operations in a more ungenial climate and on a less inviting soil. In the pastoral, semi-arable districts of our country, all practical farmers agree that plantations are invaluable for checking the force of the wind, providing shelter for their stock, and otherwise modifying the severity of the climate; and we believe that proprietors might ultimately considerably raise the value of this kind of property by judicious planting. Indeed the writer has heard an enterprising tenant in one of these districts suggest that if his landlord would plant for shelter he would ask no deduction of rent for the land required. Many thousands of acres at 900 feet and upwards above sea-level could easily be planted without impairing the pastoral or agricultural resources of the country, and at the same time there would be a greatly increased yield of timber produce besides. No doubt there are difficulties to contend with in planting at this altitude, especially if the soil is inferior and the situation very

exposed; but with a good home nursery, properly chosen, and the plants frequently transplanted, these difficulties can be overcome. It is observable that plants brought from low-lying nurseries and planted on high exposed ground have generally much difficulty in establishing themselves, and in many instances stand still for some time at first even if they do not succumb entirely to the influences of the ungenial change. The cause is not far to seek when we consider that few public nurseries are more than 250, while some are even less than 100 feet above sea-level. The effect of transplanting plants reared in these nurseries, say to an altitude of 1,500 feet, is too often apparent in the diminutive shoots and general weakness of the plant. It has been observed that in this country there is a fall of one degree in the thermometer on an average for every 250 feet of ascent. I am not sure if by any arithmetical or meteorological process the less amount of heat bestowed at any altitude can be accurately ascertained; however, it will be seen that the plants in their new location, as compared with their former, receive five degrees less heat during each day, and allowing 150 days as the period of active vegetation, they will have received a total of 750 degrees less during the season. Striking the mean temperature at 55 degrees during the period of growth at the place where they were reared, it would thus take fifteen days longer to elaborate the woody secretions in their new position.

This would be the case although there were no other elements to retard the process of ripening, but there are also the storms and moisture of elevated districts to contend with, which too generally have a greatly retarding influence. Doubtless there are some plants more accommodating, which recover from such a severe check more readily than others; but that there is a limit to this is only too evident, and many of the deaths in young plantations at a high altitude are due to this fact. In illustration of the advantage of home-reared plants for such situations, the writer will give one instance from his own experience. He was asked by his employer some years ago to replant a few acres of ornamental plantation, which was situate at an altitude of over 1,000 feet, being on the brow of a hill, where the soil was thin and stony, and the site fully exposed to the westerly winds. From the configuration, nature, and exposure of the ground, it was most difficult to plant successfully.

When I saw it, I resolved to plant it with trees from the home nursery; but being short at the time of the kind required, I suggested to postpone planting for another year, when a sufficient quantity would then be ready. It had been, I believe, twice planted before, and failed.

Being situated right in front of the shooting-lodge, the proprietor was anxious to see the plantation started, and I was, therefore, requested to proceed with it at once, and make the most of what stuff

I could buy. The result was just what I anticipated. I had a large portion of the most exposed part to re-plant the following spring, but this time it was done with home-reared plants which had no difficulty in establishing themselves, and the last time I saw the plantation it bid fair to completely answer the purpose for which it was planted. The respective seasons were not exceptional for the establishing of young trees, and both plantings received exactly the same treatment.

Another element which acts injuriously on young trees at this stage is the differently constituted soils, public nurseries being generally composed of good garden mould, containing not less than from 7 to 10 per cent. of humous. How will the change from this rich pasture affect their well-being if deported to some of our bare hill-sides, where scarcely any trace of organic matter is to be found? One characteristic of home-reared plants is, that when planted out they give immediate signs of vigour, and rapidly start into free growth. This, in itself, is a great advantage; as it appears to be the case, that the more stunted a plant is, just in proportion will it be subject to the ravages of ground game, vermin, &c.

As already stated, the home nursery will also be of great benefit to the proper training of the young forester. What is better calculated to interest him in his business, and give his mind a proper bent, than to see and engage in the active operations of the nursery? At the outset of his career, habits of carefulness and of watchful observation are insensibly begotten, which otherwise may have been lost to himself and the profession. A good deal is being said at present with reference to Schools of Forestry and the education of foresters. Some propose a course of study the details of which, at first sight, seem calculated to entirely swamp the forester endowed only with ordinary intellect; but we predict that however much scientific lore may be imparted, if not accompanied with good *practical* training, it will be found defective in its most essential parts. We have perused, with much interest, Dr. Cleghorn's account of the "Royal Forest School of Vallombrosa,"* where not only is theoretic knowledge imparted, but also a good sound practical training, such as the management of a nursery, &c.

Our method of restoring woodlands by artificial planting is adapted to the wants of this country, and is not likely to be superseded by that of natural reproduction, as practised in other countries differently situated; the rearing of plants in nurseries is, therefore, sure to remain a peculiar feature in British forestry. Although no radical changes are likely to take place in our present methods, yet, we think, if British forestry is ever to advance from that dependent position in which it is now placed and develop into a complete system, we conceive it will

* "Trans. Scot. Arbor. Soc.," vol. viii., p. 182.

be greatly helped by adopting the management of home nurseries as an essential part of that system. The amount of care and attention a nursery requires is no doubt considerable, but the great advantages, and ultimately largely increased profits to the proprietor, will far more than repay the extra outlay necessary to start it, and keep it in good order. Nursery-ground should neither be low-lying nor too much sheltered; better rather that it be somewhat exposed, for the plants thus reared will succeed best when planted out. The soil should be of a friable nature, and it is good practice to take a green crop off it occasionally, alternately if practicable, so as to clean and enrich the soil. The subject of extended planting is one well worth consideration by the owner of elevated tracts of land. With the foreign supply of timber gradually diminishing, and the development of our own internal industries, there will always be a demand for all kinds of home-grown timber. The enterprise is one which may be safely entered upon; and one element that would contribute in no small degree to its success would be the general establishment of private nurseries.

W. W. R.

The Pine Beetle *(Hylurgus piniperda).*

By THOMAS WILKIE, Forester, Ardkinglas, Cairndow, Argyleshire.

It is believed by some that this beetle is only propagated by contagion, or by allowing the branches of felled trees to lie and rot upon the ground. But recently, in passing through a young plantation formed upon fresh soil formerly cultivated, a mile distant from any other plantation whatever, and in which no cutting or thinning had ever taken place, I observed it was working great destruction upon the Scotch and Austrian pines. On inquiry I found it had never been observed till this season, although the plantation had been formed for ten years. This naturally shook my belief in the theory above mentioned, and when asked by the forester in charge what was my opinion of the case, I could give no other than that their propagation is due entirely to a counteraction of the sap, by its being retarded in its ascent or descent by uncongenial weather, such as a cold spring or possibly frosts.

Perhaps some observant person may give us some light upon this subject, for I have never yet heard any idea expressed other than that enumerated above, and some writers have advanced statements which would attribute their propagation to wasting of the branches of the thinnings as the only cause. I have no doubt whatever that they soon increase to an enormous extent when once settled in a plantation, but this may be due almost exclusively to their fecundity. But how, or by what means, were they first brought into it? Would it be, or is it possible, that they make shiftings or removals from one place to another?

As the best means to reduce their numbers, I would suggest that periodical examinations be made of all our young plantations, and with an averruncator, or pocket knife, cut off the twigs in which they are and carefully gather them into a leathern apron, or some such article, and burn them on the nearest spot of safety. Such expense would be comparatively small, as two careful boys would manage the whole operation.

For my own part I have never yet seen this insect upon the wasting branches on the ground, although I have often seen another one

much like it, though it most of all resembles a flea, and like that lively insect will spring away from your touch. This insect I have seen in hundreds upon a newly withered Scotch fir when felled. Has any one actually observed the *H. piniperda* upon dead wood? I fancy it is only an old story handed down from one generation to the other, such as those of fairies, ghosts, and witches. I have seen the *Hylurgus piniperda* on all classes of soils and situations.

Forest Songs and Poetry.

THE WALNUT TREE.

By ALFRED B. STREET.

It rears its rough, seamed column at one side
Of the wood-vista. On the other, shrinks
A tremulous white-birch the frost has made
Transparent. Golden touches through the leaves
Of the tall walnut, likewise show the breath
Of winter's messenger. The fruit has fallen,
And an embroidery of squirrel-tracks
Upon the soft black mould, the sacking tell
Of the red raiders. In warm April days
The buds perk up their leaf-ears to the songs
Of bluebirds, and then grow to velvet globes,
Making the amber meat. All summer through,
Networks of sun and shade have danced beneath
The boughs, and streaks of delicate rain have shone,
And twilight has tinged brown the trees' thick heart
Until the leaves, ripening in Autumn's glance,
Have changed to gold. From the dense, oval boughs
Have dropped the silken spheres upon the earth,
Crackling with withered leaves, and pitted late
With nest of the dun ground bird. In the depth
The robin's strain has swelled in rivalry
To the tree's hum, as sang the merry shower
Upon the patted boughs, while on her nest
His dusky mate sat brooding hour by hour,
Roofed by the leaves and circled by the moss,
All flashed the green in sunshine, either side
His little head, with its black dots of eyes,
Has swung in pretty wonder to see eyes
Brighter than his sparkling all around, as if
A flock of his own tribe was crowding round
To visit them in their home. Slim golden wands
Speckled with black and fragrant, tell the sprouts
That yet will rise to the tall parent tree,
And bear in turn their fruit.

Country Gentleman.

Girdling Trees.

A THOROUGH investigation into the effects of the practice of girdling was made some time ago by the Indian Government, and Dr. Brandis the Inspector-General of Forests, made a report on the practice of seasoning timber by girdling trees previously to felling, from which we abstract the following remarks. He says the practice of ringing or girdling is not unknown in Europe, though it is rarely adopted. An instance is on record of an extensive beech forest in Hungary, the wood of which could not be made available owing to the distance from a market. It was considered more advantageous to grow pines for timber, and in order to make room for them the beech trees were killed by girdling. In some parts of Europe oak trees are ringed previously to felling, because it is believed that the timber improves by the operation. From the information available, it does not appear that the practice of girdling trees has been adopted in India proper to any extent until within the last twenty or thirty years, and it seems probable that it was introduced from Burmah, but throughout India from time immemorial, trees have been killed by ringing for the purpose of cultivation. It may here be stated, that though in Burmah the practice of girdling teak for timber has been found convenient, it does not follow that it should be adopted in other provinces under different circumstances, and with other kinds of timber; nor, as far as we know, has its adoption been generally recommended, though girdling for timber has, in a few instances, been introduced by way of experiment. In the forests of Gurhwal a large number of Sâl trees was girdled by Captain Read shortly before the mutiny. In the Botanic Gardens, Calcutta, a number was girdled by Dr. Griffith previous to felling, and since that time almost all the trees felled at the gardens have first been girdled. It is believed that the wood, especially of mahogany trees, improves by this mode of seasoning. In 1851, Captain Michael introduced the practice of girdling teak before felling into the Anamallay forests; but in 1853 he writes that some of the planks cut that season were prepared from trees which had not been girdled, in order to ascertain whether the planks from green trees were superior in quality to those cut from girdled trees. He adds that the most experienced plank cutters are unanimous in asserting that the fall of a dead tree considerably increases the heartshake, and renders the

timber more defective, whereas a green tree felled sustains little or no damage by its fall, and planks cut from it are much more sound. Dr. Cleghorn, in his Third Report on the Madras Forests, says that the custom of ringing the tree before felling has been advocated on the ground that the seasoning is thereby expedited, and also more thoroughly effected. This is doubtful, at least in oil-containing trees (as teak). It is said to increase the hardness of the wood, and wood-cutters object to fell girdled trees on this account, and heartshake is believed to be increased. Major Morgan, in the Madras Forest Report, says that girdling teak has long been given up; it makes the wood brittle, and deprives it of its oil. Captain Beddome, in Appendix II. of the Madras Forest Report, states that the system of girdling has been put a stop to as unnecessary. Captain Beddome also writes to the Madras Government, with reference to the Forest Report of British Burmah, that in Madras girdling had long been given up as a grand mistake, it so increases the heartshake, and otherwise impairs the quality of the timber. Girdled teak is generally sold in the Malabar market at a discount of 50 per cent. upon green felled teak. Colonel Ramsay does not approve of girdling because the operation is difficult to superintend, and the trees must be felled the next year to avoid risk of fire. Many thousands of trees were destroyed in the Gurhwal forests from having been girdled. But he adds, "The theory is good, but in these forests the practice is too dangerous to be adopted." In another letter he remarks that "as soon as the sap is arrested by this process, and the tree begins to die, it is attacked by the carpenter bee, which deposits eggs in the bark, and in a short time the outer part of the wood becomes perforated with innumerable small holes; time only is required to allow these little insects to render the tree worthless. I now prohibit girdling altogether." Mr. Leeds, in the British Burmah Forest Report, is of opinion that girdling exposes the timber to two years' jungle fires, and thus risks its loss or damage; also that, owing to the brittle state of the timber when felled, a very large proportion of the finest timber is lost, which is shattered by the fall. Dr. Brandis thus comments on the above:—"The practice of allowing killed timber to season, standing exposed to a free current of air on all sides, was not, as has sometimes been supposed, introduced from the forests on the continent of Europe. It is purely a Roman practice, and is probably the best mode of seasoning teak known in this climate. The wood of a tree which has been felled green dries very slowly; that which is left standing after killing dries more rapidly and thoroughly. That the wood becomes brittle I do not think has been proved, and the hardness of the wood is not increased to such a degree as to cause inconvenience in working." Dr. Brandis then goes on to recapitulate

Increase of Heartshake. The heartshake is said to be increased by the fall of a dead tree, and by its standing exposed to the wind; and it is even said that the heartshake is caused by girdling, but it is difficult to draw a sharp line of distinction between what should be called heartshakes and what should be termed central hollows. The central hollows, or cavities, are probably formed at an early age of the tree, and it is not likely that they would increase by the process of girdling. As to Captain Michael's comparison between green and girdled wood, 100 trees should have been selected, one half to be girdled and felled after standing two years, the other half to be felled green with those previously girdled. Such an experiment, if repeated for a few years, might lead to a satisfactory solution of the question.

The wood of the tree is shattered in the fall. We have no data to prove that the wood of girdled trees which have stood two or three years is so brittle as, on that account, to be injured considerably in the fall of the tree. It is probable that this extreme state of brittleness does not show itself until the tree has stood many years, or after the wood is perfectly seasoned.

Risk from damage by insects. Insects do great damage to girdled trees in certain districts, but teak, when standing girdled, is rarely attacked by them. Sâl and other trees are frequently attacked, and sometimes, as Colonel Ramsay remarks, the wood is perforated by them. On this account girdling is not indicated in the case of pines and other trees liable to the attacks of insects, and in the case of sâl in those forests only where insects are less destructive.

Risk from the decay of wood through girdling. There are man kinds of wood which decay unless converted into scantling, and brought under shelter immediately after felling. Trees of this description should not be girdled for timber.

Relative value of Malabar and Burmah teak. Assuming that there really prevails in the Bombay market a considerable difference in the prices of Burmah and Malabar teak, it remains to be proved that this difference is not caused by circumstances quite apart from the mode in which the timber has been seasoned by girdling or otherwise.

It should now be stated what are supposed to be the main advantages of seasoning timber by girdling.

First, as to transport by water.—Girdled timber floats sooner than timber felled green, but this remark does not apply to sâl and other heavy woods which do not float even when perfectly dry.

Second, as to transport by land.—The weight of girdled trees is less than that of trees felled green. Teak, for instance, full of sap, weighs more than 62 lbs.; if seasoned by girdling, it weighs 50 lbs., and often less. On a log measuring 50 cubic feet, this, therefore, makes a difference of 600 lbs., or one-fifth of the entire weight.

Third, as to durability of timber.—Trees felled green do not season uniformly throughout the whole mass of the stem; while the upper part, which is exposed to the sun and air, dries, the lower half, near the ground, remains moist. On the other hand, when a tree is left standing after being girdled, exposed on all sides to a free current of air, there is less likelihood of decomposition and decay than in a tree felled green. This is a consideration of much importance, as this timber derives its high value from its resistance to decay.

Finally, we are reminded that the advantages of seasoning timber by girdling do not apply under all circumstances, as in the case of Admiralty teak planks, for as soon as a tree is cut up into scantlings the wood dries more rapidly than if left entire, girdled or ungirdled. Such were the differences of opinion between Dr. Brandis, the Indian Inspector-General of Forests, and his subordinates, on the question of girdling. It will be best to offer no comment, but merely to lay this condensed statement of the case before our readers, and whose opinion upon the merits of girdling timber in this country we will be glad to receive.

W. R.

The Bug attacking Silver Fir.

It has been said by some that this insect restricts itself to a certain limit from the sea, but having had considerable experience in woods adjoining the Atlantic Ocean, I find this is not the case, as I saw it often too plentifully close upon the sea, within less than a stone's cast of its shores. On this property, on the very edge of Loch Fyne, within four yards of it, many trees are covered with the insect from top to bottom, and being most anxious to preserve a few of those affected, I would be glad to hear of any practicable suggestions. so as to destroy the insect and save the trees. I at one time thought that confinement, or too close growing of the trees, was the only cause of their being infested, but I have since learned that they are often attacked, even though grown singly, as they are in many cases on this property, and where they have never at any time been crushed or crowded upon by other trees. The cause I now attribute to the same influences as that I have advanced regarding the propagation of the *Hylurgus piniperda* in another paper to this Journal.

Ardkinglas. THOMAS WILKIE.

Picea Pectinata (Silver Fir).

THIS belongs to a genus containing about thirty species, all hermaphrodite, and is one of the most graceful of all trees for lawn decorations. The wood was esteemed at a very early age. Being soft in its texture and sonite in sound, it was greatly preferred by the ancients for musical instruments. David, the shepherd, musician, warrior, and king, delighted to play before the Lord on all manner of instruments made of firwood. Again, we have Solomon writing Hiram, king of Tyre, asking for fir trees out of Lebanon, to assist him with the temple building. The fir tree is frequently used figuratively in the prophets: "Instead of the thorn shall come up the fir tree." It is only mentioned once in the Psalms: "As for the stork the fir tree is her house." The Greeks dedicated it to the goddess of hunting, as under the cool shade the huntsmen used to rest. Fir and pine boughs were wreathed round the heads of the various champions at the Pans Bacchanal, and Olympic games of early Greece. It is not known for certain when this tree was first introduced, although it is believed to have come from Switzerland in 1603. Cæsar, in his "Commentaries," says he did not see a fir-tree during his stay in Britain. Gerarde, who died in 1607, says, "I have seen this tree growing in Cheshire, where they grew in great 'plentie,' as is reported before the flood; but being then overwhelmed have lain since in masses very fresh and sound until this day. Being full of rosin they burn like a torch or 'linkie,' and are called 'firre-wood' by the inhabitants. I have seen the goodliest tree in the world growing on the wild rocky hills of Germany." The same writer remarked the fine firs of Prussia, Roumania, Tiefleland, Russia, and Norway. Pliny says the fir-tree does not thrive well near Rome, but terms those in France, Corsica, Bithynia, and Macedonia, as most graceful. The silver fir dwells in high latitudes, occupying the same isothermal zone with the pine, and is found in Europe as far north as Enontekies, where the summer heat only averages 59½°. The largest fir in Britain is, or was, at Woburn, which measured seventy feet of a clear trunk, and was altogether 110 feet high.—*Jottings from Lom. Fitt's Scrap-book.*

The Larch Bug—What is it?

By D. SYM SCOTT, Forester, Ballinacourte, Tipperary, Ireland.

Young foresters, and for that matter old ones too, will find a world of interesting information by devoting a little study daily investigating into and experimenting on the life and habit of this minute and destructive insect. This insect, as seen about the first of May, is a mere fleshy excrescence apparently void of locomotion. Its body is corded, and of an oval shape, with six short legs and a pair of antennæ. About the second week in May it begins to lay eggs, which are semi-transparent, oblong, and all attached together with a fine ligament.

Immediately after the eggs are deposited the insect gets enveloped with a coating of parasitical fungi. The eggs are hatched in a few days, and the young brood will in four days after be found coated with the white down, under which they go on producing and reproducing through seven or eight generations, when at the end of the insect season eggs are produced to continue the tribe the following summer. Most insects have three stages of life—*larva*, *pupa*, and *imago*, but with the one under discussion I have detected no metamorphosis whatever. This is simply an outline of their development; a closer observation will disclose much more interesting matter.

Being anxious to see this subject get an airing in this Journal I herewith give my own ideas, trusting they will provoke discussion. Early in May only females are found, and they produce their eggs before being covered with fungi. The first brood contains both males and females. The males after congress disappear, but the females go on producing through several generations when males are again produced, with the result that eggs are deposited which remain over winter. By watching the insect narrowly it will be observed that the first and last broods have a per-centage of winged insects, smaller and more nimble than those which are wingless. The former I accept as males, the latter as females. Another thing I would draw attention to,—the first brood is a few days before being covered with fungi. Succeeding broods get covered immediately on leaving the egg. Incubation takes place very quick in successive

generations, so much so indeed that one is apt to mistake the insect as being oviparous and viviparous at different stages of life. They are, in my opinion, ovi-viviparous—*i. e.*, by a process of internal gemmation the eggs are produced partially hatched, which somewhat accounts for their extraordinary fecundity. With regard to the relation of sexes, I believe the insect to be a sexual, possessing the power of multiplying for a given period without intercourse. A succession of fruitful virgin aphides have been traced by Bonnet through nine, and by Davan through eleven generations, and Kyber kept a colony of them for four years without once seeing a perfect male insect. Having said the tribe is continued by eggs deposited in autumn and generating the following spring or summer, the question may be put, Will the severe frost of the north of Scotland not destroy the eggs? As to this, it has been tested over and over again that germs of organisms will retain vitality under a much lower temperature than living organisms themselves. I am, however, at a loss to know the meaning of the generic name ADELGIS as applied to this insect, and feel inclined to call it a species of *Coccinæ*, and grouping with the *Aphis* in the sub-order *Homoptera.*

The insect being distinctly injurious to larch, a few words may be here added suggesting a cure. A writer at page 105, in the last vol. of "Scottish Arboricultural Society's Transactions," says plants can be thoroughly cleansed by being, while in the sheugh previous to planting, syringed with a solution of perchloride of mercury. Possibly this may be so, but I doubt it much—although at the same time I never tried it, because I fail to see how poison can affect the eggs so as to destroy the germ. What I would suggest is that the plants be well syringed with a solution during July on one or more occasions, to make sure of destroying the insect as it emerges from the egg. The insect being suctorial, I am confident that any insect poison if timeously applied will effectually extirpate this destructive pest.

Spruce Timber.

In the numbers hitherto issued of the Journal I observe various parties discussing the durability of spruce timber. My own observations lead me to the conclusion that its durability depends not so much upon its age, kinds of soil grown upon, or whether in a lowland or highland country, as does the thorough seasoning of the timber, and the amount of ventilation it may afterwards get when applied in constructions. If green unseasoned timber lie long in a damp state, and is used in that state, unquestionably a fungus will have got itself spread over the greater portion of it before it is used, and if applied for partitioning under lath and plaster, or where there is bad ventilation, either spruce or any other class of timber would soon waste, as dry-rot always follows the fungus. I have seen a farm standing after being forty years erected, and examined the whole of the wood, which was quite sound except the roof of the threshing mill, and above the water-wheel. These parts were the only places where a want of ventilation occurred, and they were literally rotten and had to be renewed. In their renewal with green timber, good ventilation was introduced by making it along the whole side of the roof, and I found that it dried as quickly as if stacked outside under a mean temperature; and for roofing or any other coarse piece of work that does not require dressing, it is as good as any other class of timber generally used. I have seen young spruce wood that was sawn into common fence railing last for thirty-one years, and except when in contact with the stobs or at the joinings, it was as fresh as when put up. It was, however, frequently coated with coal tar well boiled. I would suggest in passing that a small piece of hard wood be placed between the stob and the rafter, say the whole width of the rafter, $\frac{5}{8} \times \frac{1}{4}$ thick, in which a hole could be bored for the nail to pass through.

This could also be done at all joinings of the rafters along the whole line of the fence; of course a longer nail would be required, but the lengthened durability would more than repay the extra cost of nails. I know of a building only constructed five years ago, with good foreign timber, and which is now completely rotten, and must be pulled down. Similar facts could be adduced on both sides of the question, but I believe these are sufficient at present to establish a

sound belief in the absolute necessity of having wood well seasoned and thoroughly dry before it is covered up, as also the need of good ventilation in all constructions, let the class of timber be what it may; and I believe if our home timber was as well seasoned as the foreign timber is before we get it home, and applied for the construction of buildings, it would very soon come to be more highly esteemed as well as more extensively used.

And why not season it well? At every proprietor's saw-mill wherever I go I scarcely ever find anything like a stock of seasoned wood.

A twelvemonth's supply ought always to be kept in stock. The logs could be squared, or a lot of it could be cut into different sizes of battens, ready to be further manufactured as required.

Regarding the best method of preserving stobs, none can surpass thorough seasoning, then charring and tarring. If the brush and weeds are kept well down, stobs carefully handled in driving may stand for thirty years. I know a fence that stood on the west coast of this county for thirty-one years; the stobs were treated as above, and frequently tarred, a good thick coating being always put upon the top of the stob: the ground was pretty level and indifferently drained.

THOMAS WILKIE,
Forester.

Ardkinglas.

Sherwood Forest.

MANY perambulations of this forest were made in different reigns; one in the 28th of Edward I., another in the 30th of Henry VIII. and a third in the 14th of Charles II. The forest is described in a survey made in 1609, as being divided into three parts or districts, called the north, south, and middle parts. The whole quantity of ground was as follows according to that survey:—

	A.	R.	P.
Inclosures . . .	44,839	1	11
Woods	9,486	0	23
Wastes. . . .	35,080	2	6
	89,406	0	0
Clipstone Park . .	1,583	1	25
Beskwood Park . .	3,672	0	0
Bulwell Park . .	326	3	2
Nottingham Park . .	129	3	9
	95,117	3	36

According to this survey there were found to be in 1609, 21,000 oak trees in Berkland, and 28,000 in Bilhalgh, and the trees in general, even at that time, were past maturity. By another survey in 1686, there were in Berkland 12,516 trees, and 923 decayed hollow trees, and in Bilhalgh 21,080 trees, and 2,797 hollow trees. By a survey in 1797, there were in Berkland and Bilhalgh together, only 10,117; these at the time were estimated at £17,147 15s. 4d., so that in seventy-seven years (from 1609 to 1686) 2,593 trees had been cut down, and in 104 years (from 1686 to 1790) 27,199 trees were so dealt with, but in so long a period many may have been laid low by the effects of the wind. The officers of the forest used to be a lord warden, a bowbearer and ranger, four verderers, a steward, clerk of the Swainmote, nine keepers, and a beadle. Rooke in his "Sketch of the Ancient and Present State of Sherwood Forest," says that letters have been found cut or stamped in the body of the trees, marking the king's reign, and gives engraving of such letters found in the middle of oaks. One has the hollow or indented letter I and R, for James Rex, a second has the

same letters in relief, which filled up the interstices of the former, before the piece was split.

It is remarkable, that where the bark has been stripped off for cutting the letters, the wood which grows over the wound never adheres to that part, but separates of itself when the wood is cut in that direction. The third has the letters W M, with a crown, for William and Mary, the fourth has the letter I, with an imperfect impression of a blunt radiated crown, resembling those represented in old prints on the head of King John, and another piece cut out of an oak, had the same kind of crown with I O and R, for John Rex. The first piece of oak, with the letters I and R was about one foot within the tree, and one foot from the centre; it was cut down in 1786. That with W M and a crown was about nine inches within the tree, and three feet six inches from the centre, and was cut down the same year. The piece marked I, for John, was eighteen inches within the tree, and above a foot from the centre; it was cut down in 1791.

The same writer remarks that this extensive grove of ancient and majestic oaks is beautifully diversified by the slender and pendent branches of the silver-coated birch. Many of these venerable oaks are of extraordinary size, and undoubtedly of very great antiquity, one may venture to say at least a thousand years old. Several of them measure about thirty-four feet in circumference, and notwithstanding the hollowness of their trunks, their tops and lateral branches are rich in foliage. So late as the beginning of the eighteenth century this forest was full of trees, as the Rev. Dr. Wylde, Rector of St. Nicholas, Nottingham, placed it on record that he had often heard his father, who died in 1780, in the 83rd year of his age, say, that he well remembered one continuous wood from Mansfield to Nottingham. Some of the trees remarkable for their antiquity, and which were in existence at the commencement of the present century, are an oak on the west side of Clipstone park, called the Parliament oak, from a traditional account of a Parliament having being held under it in the reign of King John, or probably Edward I. (they both resided in the palace of Clipstone); the broad oak at the north end of Clipstone park, twenty-seven feet six inches in circumference; also the Langton Arbour Elm, and the Raven Oak.

The same mismanagement and downright dishonesty which other forests already noticed suffered from, are displayed in the history of Sherwood forest. In 1716 the surveyor-general of the woods held a sale of trees which had been blown down by a storm. These trees were valued by the verderers at £2,473 9s. 4d. But in the account sales which was not passed before the auditor until 1746, the produce was stated to have only £850, and that sum exactly was expended in fees and allowances to the surveyor-general, and the expenses in the

cutting and disposal of the timber, and the account was declared to be even. It is worthy of remark, that in order to produce that exact equality between the charge and discharge of the account, the Surveyor-General charged no less than 800 days attendance of two deputies at 4s. each per day, in the execution of the warrant for the sale of the timber. Another article in the accounts of this forest, may, perhaps, also observe notice. On an application from the Duke of Newcastle, in the year 1709, a very broad riding was cut through the whole of Berkland wood, from one end to the other, and the timber, which was valued at £1,500, was given to his Grace, but all the charges attendant on the fall were defrayed by the crown, and amounted £118 17s. 2d.

Again, the four verderers claimed five trees yearly, and the steward of the Forest Courts a like number, and were accustomed to take their choice. But as a standing tree may be unsound, and yet present no outward sign of decay, these guardians of the public property allowed those with whom they were in treaty to bore the finest looking trees until they come to one to their liking, which practice was hardly conducive to the health of the rejected ones. While the red deer were kept in the forest, the farms were worth very little, and the farmers were obliged to watch and blow horns, and keep fires by night to keep them out of the corn fields, but the farms rose considerably in value after they were destroyed. Plans were at different times proposed, during the eighteenth century, for replenishing the forest with deer and preserving them, but they had no other effect than bringing expense upon the crown and advantage to the proposers, without any increase in the deer. In 1703, the Duke of Newcastle, Lord Warden of the forest of Sherwood, represented, that for the preservation of the deer and increase of the game, it was absolutely necessary a competent allowance should be made, not only for the maintenance and support of a sufficient number of keepers, which he conceived could not be less than six, and their deputies, but also for providing hay and pasture ground for the fothering and support of the deer, and, in consequence of that representation, he obtained a warrant for £366 per annum, to be paid by the surveyor-general of the woods north of Trent, out of moneys arising from the sale of windfalls, and of dotard and decayed trees, and to be distributed by his Grace in the manner proposed, and that payment was continued until Michaelmas, 1707. In 1709, the Duke obtained by letters patent licence to make a park within the forest, to contain at least 3,000 acres of his own land, and in consideration of thus extinguishing the rent of such a quantity of his own lands, and of finding hay and pasture ground, not only for the deer to be kept in the said park, but for those in the forest also, and of paying all the keepers both in the park and the forest, and defraying

all other charges incident to both, a yearly fee or salary of £1,000 was granted to him, payable out of the Exchequer, and to commence when the former payment of £356 ceased, and this salary was paid until the death of Queen Anne in 1714. It appears therefore, that the Duke of Newcastle, instead of paying any compensation to the crown for exonerating 3,000 acres of his lands, before exposed to the range and haunt of all the deer in the forest, converted that circumstance into a ground of claim for an increase of salary. It appears also, that notwithstanding these provisions for the increase of deer, their numbers gradually lessened, and they became altogether extinct about the year 1770.

We have thus seen what the forest was in old times down to about the close of last century, and it will not be difficult, from what has been stated, to find good reasons for its decay, a decay so marked as to justify the remark of the tourist who declared that if Robin Hood were alive, he could not find shelter in it for a week.

Old Trees at Shobdon Court.

Shobdon Court is the seat of the Right Hon. Lord Bateman, Lord Lieutenant and Custos Rotulorum of the county of Hereford. It is a brick mansion in the style of Louis XIV., and has a beautiful entrance-hall.

The mansion erected by the first peer, about a century and a half ago, has lately undergone such alterations and improvements as to have been almost rebuilt, and the application of the most correct taste in modern land scape gardening has done justice to the noble timber. Two splendid Chestnuts (Spanish) one 15ft. in girth, another 15ft. 2in.; a gigantic but decapitated Cedar, one of the finest in England; two very luxuriant and exquisite Occidental Planes, and one or two very fine Beeches stand within the lawn and near the flower garden; while round and about within judiciously calculated proximity are still finer Spanish Chestnuts, Cedars, English and Evergreen Oaks, bespeaking a venerable but hale old age, and standing out in bold relief amid lesser and younger coniferous and deciduous sojourners in a park of remarkable beauty lying in front and around the mansion, and having a boundary of some four miles in extent. In one part of the park not far from the mansion it is impossible to pass by some Cedars of Lebanon without noticing their truly remarkable size; one trunk broken short off by some dire calamity at about 25 feet high, but with a yet perfect bole, gives a fair measurement of no less than 18 feet 2 inches in girth at 5 feet from the ground. But even this tree was surpassed by one in much more perfect condition on the lower ground, for this fairly girthed 21 feet 10 inches at 5 feet from the ground, though lower down it was somewhat less. These trees are certainly the finest Cedars in the county, and there is reason to believe that they were planted about 1688, when the Cedar tree seems to have been first introduced into Herefordshire.

Forest Officers and their Duties.

THE origin of the laws and regulations of forests seems to be involved in equal obscurity with that of the forests themselves; but if we except the Justices in Eyre, there was no officer who had any general superintendence of the forests before the reign of Henry VIII. But in each forest there was a distinct set of officers, viz.:—

1st. Verderers, or judges of the Swainmote Court, and directors of all the other officers in the forest. There were usually four in every forest.

2nd. Regarders, who were to go through the whole forest, and make their regard every third year; to inquire of all offences in the forest, and survey all "assarts, wastes, and purprestures." There should be twelve regarders in every forest.

3rd. Foresters, whose duty it was to preserve the vert and venison in the forest, to attack offenders, and present offences at the forest court. The number was determined by the occasion for them in each forest, according to the discretion of the regarders.

4th. Agistors, whose office was to receive and account for the agistment or profit arising from the herbage or pannage of the king's woods and lands in the forests. The full complement was four to each forest.

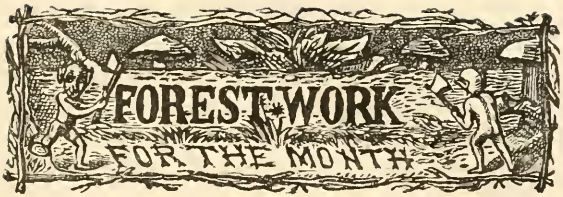
5th. Woodwards, whose charge was to look after the woods, and to present offences therein at the forest courts. Their number does not seem to have been determined.

6th. A steward whose duty it was to attend the courts of Swainmote, and assist the verderer, or judge. Besides these officers there were usually a Lord Warden, lieutenant, or master forester appointed by the king in each forest, and probably other officers, according to local custom. There were three courts appertaining to the forest, namely, the Court of Attachment or Woodmote, the Court of Swainmote, and the Justice Seat, or Court of the Chief Justice in Eyre. The first two of these courts were composed of the officers in each forest. The Court of Attachment or Woodmote was expected to be held every forty days, every officer in the forest attending. This court was to inquire into all offences of every kind done in the forest, and to present them at the Swainmote

Court, and to the Lord Chief Justice in Eyre. The Court of Swainmote, in which the verderers were judges, was supposed to be held three times a year: the first court, fifteen days before Midsummer, for the purpose of clearing the forest of all animals except deer for the next month, which was called the fence month, which is the fawning season, and the deer require to be undisturbed; the next, fifteen days before Michaelmas, when the herbage money for cattle was received, and the swine admitted to feed on acorns and beechmast, called pannage; and the third court forty days after Michaelmas, on the feast of St. Martin. At that time the forest was again cleared, and no animal except deer admitted from the 11th November until the 23rd April (old style), which period was called the Winter Haining. At this court the presentments of the Court of Attachment were received and enrolled, the smaller offences tried, and those of more importance presented to the Justice in Eyre, to whom the rolls of this court were certified at the next sessions of Eyre, and those rolls were expected to contain an account of every offence committed, of every deer killed, and of every tree felled in the forest; by what warrant, and of what price or value; with every fine imposed, and the agistment or money paid for the pasturage of cattle and pannage of swine. The court of justice seat was to be held in each forest once in every three years.

Though many of these ancient regulations appear to be well calculated for the preservation of the forest, yet even as early as the reign of Henry VIII. some other regulations were deemed necessary. In the 33rd year of that reign an Act was passed establishing a court called the Court of General Surveyors of the King's Lands, which was to consist of the king's surveyors, a treasurer, an attorney, the master of the woods, auditors, general receivers, a clerk of the court, an usher, and messenger. This court had a general superintendence of the lands belonging to the Crown. The master of the woods was empowered, with the assent of the court, to make sales of wood, &c., in the forest, and none could be cut without his warrant and the assent of the said court. But in the thirty-eighth year of the same reign that court was dissolved, and a new one called the Court of Augmentations was created, and invested with all the powers of the former court. One master and one surveyor for the month, and one of each for the north of the Trent, were members of it, and in each district wood sales were ordained to be made by the certificate of the surveyor, and by the commission of the master of the woods, with the consent of the Justice in Eyre. Both these courts seem to have been very well constituted for the remedy of what was defective as to the preservation of timber, and in the administration and management of the forests under the forest laws. From the account which has been given of the Courts of Attachments and

Swainmote, of the duty of the different officers within each forest, and of the power of the Justice in Eyre, it appears that ample means were provided for the care and preservation of the forest, for guarding against intrusions, and for the punishment of offences, so long as the functions of those officers were properly executed. But the power vested in the Chief Justice in Eyre himself was often abused, and that officer irregularly disposed of timber in the forest for his own advantage. This abuse the authority given to those courts was well calculated to prevent. By uniting the different officers, the surveyors-general, the masters of the woods, the receivers and the auditors in one court, they would have been a check upon one another, and if either of these courts had been continued, and had acted in conjunction with the forest officers as was intended, great profit to the country would have been the result. But the last of these courts being established only by letters patent, it had perhaps on that account the less weight; and the Justices in Eyre, who had usually but improperly taken upon themselves to make wood sales, and who happened during that and the succeeding reign to be men of great power, counteracted the measures of the Court of Augmentations, and made great waste of the timber for their own profit—in fact, they stole it. And although that court was afterwards confirmed by Act of Parliament, power was given by another Act to Queen Mary to alter, change, transpose, dissolve, or determine the Court of Augmentations, and she did accordingly soon afterwards dissolve that court, and by other letters patent annex the same to the Court of Exchequer. According to such articles and ordinances as were contained in a schedule annexed to the letters patent, by one of those articles no wood sales could afterwards be made without a commission from the Lord Treasurer and two such other of the court as he should call to him at the time, or in his absence by the Under Treasurer, calling to him two of the said court; and another article gives power to the Lord Treasurer and the Court of Exchequer to amend, reform, and correct any clause or article therein contained, and to make such further order as the court should think expedient. The Court of Augmentations was thus dissolved, and its powers transferred to the Court of Exchequer; but the system of management being still found to be defective, a surveyor-general of the woods was afterwards appointed, which office existed for a very long period, and finally the control of the forests was vested in the Commissioners of Woods and Forests, who are at present the custodians of the public interests.



ENGLAND.

All ground intended to be planted during the ensuing season ought to be cleared, drained if necessary, and fenced with as little delay as possible, while the weather is dry, and the soil in the best state for transporting heavy fencing materials over it. It is the best plan, where the soil is of ungenial nature, to dig the pits at the present time, and to leave the soil cast out of them exposed to the mellowing influence of the weather till the planting season arrives, which will sweeten and enrich it to the great benefit of the young plants. The bigger the hole is dug out the better, and in no case where it is intended to plant oaks or other valuable hardwood trees ought it to be less than 18 inches diameter by 15 inches deep, with the "pan" or subsoil at the bottom, broken up with a foot-pick, or some other similar tool; as it is of much importance that water should not stand in the bottom of the hole after the tree is planted, but freely percolate into the subsoil.

Prune forest trees, and also ornamental trees and shrubs, which will now have finished their summer's growth. Finish pruning or switching the summer growth off hedges as quickly as possible. Keep all young hedges clear of rank weeds and grass. Nothing spoils a young hedge sooner than allowing it to be overrun and smothered with rank vegetation.

Look over ornamental trees which were transplanted during last spring, and see that all the ties, stakes, or other supports are in good order, and not cutting or chafing the bark, re-tying where necessary, to withstand the autumn gales. About the latter end of the month is an excellent time to transplant all evergreens, choosing cloudy, moist weather for the operation. They will be able to lay hold of the ground while there is some heat in it, and get well established in their new quarters before the severities of winter come upon them, and if they come through the winter unharmed, they are better prepared to withstand the parching droughts from which spring-planted evergreens suffer so much.

Oak coppice, which has been cleared during the present season, should be carefully gone over to see that all the stools are properly dressed and the brushwood collected, made into fagots and stacked

for use during the winter, or sold at once if not wanted for home consumption. Attend to the open drains, and see that they are cleared of all rubbish, and get all the fences which have been injured during the process of clearing the coppice, put into good repair. The cordwood ranges and fagot stacks should always be built near to a gate, so as to avoid taking heavy lumbering waggons through amongst the stools, and thereby inflicting much injury on the adventitious buds from which the next crop must proceed.

Thin out the shoots from coppice stools cut over last season, leaving two or three more shoots than may be necessary for a crop; these shoots to be thinned out in the course of a year or two, when it can be better seen which shoots are the best to leave to grow to a full size. Such second thininngs ought to be carefully saved for nursery or garden stakes, for which there is generally much demand when the shoots are straight and clean-grown.

Look out for beetles and caterpillars preying on the young shoots and leaves of specimen Conifers, and take all available means to stop their ravages, as the injury they inflict is not soon overcome, especially if it is the leader they have attacked. Should the leader of a specimen Conifer have been injured a year or two ago, and not giving signs of forming another good leader, tie up the best placed and strongest side shoot, which will quickly form a nice leader, if proper precaution is taken to stop the points of all the other shoots likely to compete with it.

SCOTLAND.

Oak plantations which have been thinned during the bark season should now be gone over with the hand-saw, and all dead branches cut off close to the trunk of the tree. The woodman should also carry an old hedge knife with him, and trim all the spray off the boles of the trees as he goes along. He will also find many straggling branches hanging down, in consequence of their having lost the support of those trees which have been cut during the recent thinning; these should either be lightened, if it is possible to do so, or else cut off altogether, as they are sure to be twisted by their own weight before the winter sets in. The oak brushwood by this time will be quite dry, and it should be disposed of before it rots, either by being made into fagots for sale or burned on the ground. Foresters are finding out that in proportion as they keep their plantations free from decaying brushwood, so in proportion are they freed from insect pests, and along with that advantage a plantation looks a great deal better, and any work that requires to be done in it is accomplished with half the difficulty, when the brush is systematically cleared off the ground.

Old trees in pleasure-grounds and in the vicinity of mansion-houses should also have the spray cut from off their stems and bases this month, as it can be better seen while the foliage is on.

All branches encroaching on the sides of walks or drives should be cut in, and those which are hanging too far down from overhead should be shortened with a knife or light pruning-hook.

The extraordinary growth of nettles, and other rank forms of vegetation, this season is sure to choke up the open drains in plantations, if they are not cut and forked out to a safe distance from the drain. A common reaping-hook fastened into a handle five feet long is a capital implement to use for this work, as a man can use it with great freedom and ease, even amongst the strongest nettles in thick plantations.

It is to be hoped that all the bark ranges will be cleared by this time, and when they are taken down make sure that every stob hole is beat full of soil, more especially if the ranges have stood on drives, or any place where horses are likely to pass over, as one of these holes is quite enough to endanger the life of both the horse and his rider.

ROBERT BAXTER,
Forester.

Dalkeith Park.

IRELAND.

THE chief point in rural economy is to utilize the local products to the best advantage; hence the importance of fully comprehending local requirements. Forestry, above all other branches of rural industry, requires to be reduced to a system, the success of which depends entirely on the skill, judgment, and tact of the forester. No competent forester will neglect surrounding circumstances; and in Ireland, where farm labour occupies most of the farmers' attention during the summer months, sales of timber if held would be but poorly attended. The hay being all saved, and the after grass requiring fencing, the end of this month will be found a very good time to have an auction of small thinnings suitable for paling and stack-yard purposes generally. Timber suitable for those purposes is the only material which ought to be exposed for sale by auction at present. Heavier trees may be marked at the same time, and felled later on in the season, when such stuff is more in request. At all auction sales the material offered ought never to be in excess of the demand, and to guard against this, and at the same time to increase the number of customers, shows the forester's ability. Public auctions, so far as we have seen, are rather loosely conducted, and to assist such as may choose to follow our system we will give an outline of our practice. As commonly done, we select and arrange the timber into lots, keeping each size, kind, and quality distinctly separate. An auctioneer is engaged, and the whole sold under certain "conditions," which are audibly read at the beginning of the sale. Purchaser pays, in addition to his bidding, five per cent. as auction fee; the auctioneer

is responsible for amount of sale, which, according to "conditions," is immediate cash.

All ground intended for planting ought now to be enclosed, drained, and cleared of rank whins, and all brush which will interfere with planting operations. If the fence is to be wire, select a warm, sunny day to put on the wire. A wire properly strained on a warm, dry day will prove much tighter than one put on during damp weather. On mountain land to keep out sheep we should recommend a fence 3 feet 9 inches high, with six wires, fine No. 6 and one No. 4, to be divided from the surface of the fence line into four 6's, one 7½, and on 10 inch spaces; this makes a capital sheep-proof fence.

Transplanting evergreens may be begun towards the end of the month. We have transplanted large silver firs during the last fortnight of August with the greatest success. When this work is done early in autumn apply ample water well mixed with charcoal, and never fear the result.

Many of the woods in this country are game covers, and of course must now be kept quiet, but it is necessary, as soon as the young birds are strong enough to roost in trees, to clean all the shooting drives and head down overgrown rocket shooting coverts. Game covers may be extended by laying holly, laurel, &c., &c.

All fences ought to be kept in good repair, as grass will be getting scarce on the commons, and live stock will find a gap if there is one in the fence. Hedges should now be trimmed, avenues and coach approaches pared and cleared.

This wet season has made the saving of bark a difficult task; we have seen no sales effected, but buyers are offering from £6 to £6 10s. per ton. Sellers are asking £7 per ton weight delivered in rick.

In the nursery, budding, layering, and planting cuttings should be attended to. This is, in our opinion, the best time to propagate by layering and cuttings. Look over newly grafted and budded stock, pinch off any irregular shoots from the former, and loose the matting above the shield and re-tie the latter. Dig clean and prepare ground intended for autumn seeds, and keep down all weeds.

Paint and tar fences, houses, and all outdoor wood erections before winter sets in. A very good plan for houses is to mix hot lime with the tar, give the roof two coats, and just before it dries, throw a lot of dry sand over it. Don't spare the sand, as the wind will blow off what does not adhere to the tar: this mixture forms a hard crust, preserves the timber, and keeps out the rain. We use this paint on our bark barns.

As felling and planting operations will soon commence on a large scale, odd jobs ought to be wound up this month to be able to concentrate the workmen when required.

Potato blight has made its appearance in several gardens in the south of Ireland.

D. Sym Scott,
Forester.

Ballinacourte, Tipperary.

WALES.

During the latter half of the present month (August) and the first half of the next we perhaps do less work comparatively than during any other part of the year. This is owing mainly to the extra expense of labour at this season, it being the custom to pay all our workmen much higher wages during harvest than at any other time; while it is desirable to allow as many men as possible to be engaged in securing the crops of the soil. Harvest hands are generally engaged weekly at wages ranging from 20s. to 25s. per week with their food, and other labourers, at whatever work employed, are paid the same wages, for one month, with an allowance of 1s. per day extra in lieu of victuals. It is the practice, therefore, to keep on only as many men as are actually required, for cleaning, &c., during the harvest season, and to allow the remainder to engage for harvest work for one month with the neighbouring farmers; the latter thereafter returning to their usual occupation. This arrangement works well, and appears to be advantageous to both parties. Generally speaking the work necessary to be done at this season is not very heavy, and may be performed by a limited number of labourers.

During the period the workmen should be employed in preparing mountain ground for planting during the coming season; by cutting and clearing the gorse and loosening the soil by picking—instead of pitting—so as to be ready for notch planting, and enclosing the same by wire fencing.

Also in mowing, and cleaning up all rides and shooting drives, and cutting thistles, docks, &c., round the margins of plantations, and among young trees, before seeding. This work should, if possible, precede the harvest, so that the game on being driven into the woods, as the crops are cut down, may not be disturbed by the operations.

We are cleaning, hoeing, and weeding, and towards the end of the month we will be switching hedges. Hoeing, weeding, and cleaning in nursery grounds is being proceeded with, especially during dry weather, which should always be taken advantage of. In such weather the destruction of weeds is facilitated and the cleaning thereby accelerated.

Mowing dressed grounds, gravelling and rolling walks, and cleaning in pleasure-grounds as last month, are being continued.

There were heavy rains with thunder and lightning in this district, from the night of 13th to morning of 16th July.

Kinmel Park. Lewis Bayne, *Forester.*

PRICES OF SAWING.

SIR,—I am sorry I was unable to reply sooner to your correspondent ("Fair Play," page 118) as to the prices of sawing. As these may be of use generally, I give a full catalogue of the various sizes usually cut by Scotch timber merchants, and the prices they pay to the saw-miller or contractor, the timber merchant supplying the machinery and an engine tenter or driver.

These prices vary slightly in different localities, and whether water or steam power is used, the insufficiency of either may alter the price 6d. per 1,000 superficial feet of boarding or staves, and other sizes in proportion.

Parties who get wood sawn at these mills generally pay from 30 per cent. to 100 per cent. more than the prices quoted below, but all refuse belongs to the party who owns the wood, *unless* there is an agreement to the contrary. The backs or slabs and all other refuse belong to the wood sawn, and cannot be retained by the saw-miller without consent of the party who owns them ; but to avoid mistakes, the terms should be distinctly specified and agreed upon previous to commencing the work.

Larch and Fir	Railway Sleepers,	9	feet by	10	by	5	@	8/4	per 100.
,,	,,	9	,,	10	,,	4½	,,	8/4	,,
,,	,,	9	,,	8	,,	4¼	,,	7/6	,,
,,	,,	9	,,	8	,,	4	,,	6/6	,,
,,	,,	8	,,	8	,,	4	,,	6/6	,,
,,	,,	8	,,	7½	,,	3¼	,,	6/6	,,
,,	,,	7	,,	7	,,	3½	,,	6/6	,,
Squared fence-posts		6	,,	6	,,	3	,,	4/6	,,
,,	,,	5	,,	5	,,	3	,,	4/6	,,
,,	,,	4½	,,	6	,,	3	,,	4/6	,,

Pit Sleepers, 3 feet 9 and 3 feet 6 by 5 by 2½, 1/6 to 1/9 per 100 pieces.

Scantling, Joists, Beams, &c.		8	inch. by	8	inch.	10/-	per	100	feet lineal.
,,	,,	8	,,	2	,,	7/6	,,	,,	
,,	,,	7	,,	4	,,	7/11	,,	,,	
,,	,,	7	,,	3½	,,	7/11	,,	,,	
,,	,,	7	,,	3	,,	7/6	,,	,,	

Scantling, Joists, Beams, &c.,	$6\frac{1}{2}$ inch by	3	inch	6/3	per 100 feet lineal.		
,, ,,	5 ,,	5	,,	6/3	,,	,,	
,, ,,	5 ,,	$2\frac{1}{2}$	,,	4/2	,,	,,	
,, ,,	5 ,,	2	,,	3/6	,,	,,	
,, ,,	5 ,,	$1\frac{1}{2}$	,,	3/4	,,	,,	
,, ,,	4 ,,	4	,,	5/5	,,	,,	
,, ,,	4 ,,	$1\frac{3}{4}$	,,	3/4	,,	,,	
,, ,,	4 ,,	$1\frac{1}{4}$	,,	3/-	,,	,,	
,, ,,	7 ,,	7	,,	10/-	,,	,,	
,, ,,	6 ,,	6	,,	7/1	,,	,,	
,, ,,	6 ,,	$2\frac{1}{2}$	,,	5/-	,,	,,	
Boards and Planks (fir)	3 inches thick			10/-	per 100 sup. feet.		
,, ,,	2 ,,			8/4	,,	,,	
,,	1 inch, $\frac{7}{8}$, and $\frac{3}{4}$ inch deals			6/-	,,	,,	
,,	$\frac{5}{8}$,,			5/-	,,	,,	
,,	,,			4/6	,,	,,	
,,	$\frac{3}{8}$,,			4/-	,,	,,	
Larch barrel Staves and Heading	$\frac{5}{8}$,,			6/-	,,	,,	
One-fourth part to be	$\frac{3}{4}$,,			6/-	,,	,,	
Scots fir and spruce staves	$\frac{3}{4}$,,			5/-	,,	,,	
,, ,,	$\frac{5}{8}$,,			4/6	,,	,,	
,, ,,	$\frac{1}{2}$,,			4/-	,,	,,	
Firkins and half-firkins 1 ft. 4 by 1 ft. 10 $\frac{5}{16}$ in. deals				2/-	per 1,200 pieces.		
Boxwood $\frac{1}{4}$ and $\frac{5}{16}$ sized			,,	3/9	per 1,000 sup. feet		
Box bars, long lengths			,,	1/6	per 100 lineal feet.		
,, short do.			,,	2/-	,,	,,	
Split crowns (pitwood), $5\frac{1}{2}$ feet by 5 by $2\frac{1}{2}$				3/-	per 100 pieces.		
Ordinary fence posts $5\frac{1}{2}$ feet and pointed				4/-	,,	,,	
,, ,, rails 4 ft. by $1\frac{1}{4}$ and 4 ft. by $1\frac{1}{2}$				2/- to 2/6	p. 100 lnl. ft.		

In comparing the sizes and prices together, it will be found that they are not at all uniform, the prices being generally regulated by the *size of the round timber*; different diameters being taken for the various sizes to be sawn, so as to give the least possible amount of work and waste of material. At the above prices the saw-miller or contractor measures (for his own information) and piles the timber so cut to dry at such distances apart as may be agreed upon. He has also to keep the saws in repair, and provide oil and files at his own expense, but of course much depends on the "previous agreement," which should never be omitted.

D. F. McKenzie,
Forester, &c.

Meldrum House, 8th July, 1877.

RHODODENDRONS.

SIR—Being in the vicinity of Manchester on the 20th of June, I paid a visit to Heaton Park, the seat of the Earl of Wilton, and in looking through the extensive and admirably kept gardens, ornamental grounds, and plantations, I was much struck with the magnificent display of rhododendrons, then in full bloom, and as some of the individual plants are unusually fine, a few notes about them may be interesting. The largest and finest plants of *Rhododendron ponticum*, which were planted by the late Countess of Wilton somewhat over fifty years ago, were amongst the first of that species introduced into Lancashire, being raised from seed produced by the original plants brought to this country from Gibraltar about a hundred years ago, by Mr. Clowes, of Broughton Old Hall, near Manchester. These plants are eight in number, and range from 10 feet to 16 feet in height, with a circumference of 80 feet to 120 feet, perfectly circular in outline, in luxuriant health, and covered from base to crown with a perfect sheet of bloom, producing a most lovely and striking effect upon the landscape.

Those in masses and clumps, on the sloping banks and in the shrubberies, were also most profusely in bloom, and are freely interspersed with azaleas, laburnums, double white, pink, and scarlet thorns, lilacs, hollies and purple beeches, which heightened the effect and brought out their beauties to perfection, and produced a sight worth going many miles to see. These plants, I was told, usually flower finely in this part of Lancashire, although quite within the range of the smoke from the factory chimneys of Manchester, some of which are hardly a mile distant. But this year they are exceptionally fine, although quite a fortnight later in flowering than usual, owing to the lateness of the season in this district as elsewhere.

The species of rhododendrons grown at Heaton Park are not numerous; among the older plants, *R. ponticum* and its varieties being the predominant sort, with some fine plants of *R. campanulatum* and *R. arboreum*, and their varieties. But we are pleased to observe among the younger plants which have been introduced to the park in recent years many of the finest hybrids of arboreum, catabiense, &c., from the celebrated collection of John Waterer and Sons, of Bagshot, Surrey, and which appeared to be perfectly at home, and were in fine flower, so that in the course of a few years more they will add greatly to the charms of an already lovely scene. VISITOR.

SYCAMORE WOOD.

SIR,—In looking through the Journal for this month (July) I find in the review of the Practical "Timber Merchant," page 207, that the Plane or Sycamore wood is represented as not being subject to be destroyed by worms. Now my experience teaches me quite the reverse. I find that for whatever

purpose Sycamore is used, unless there is a certain amount of friction constantly applied to its surface, worms are sure to get into it in preference to any other timber. For instance, if a table-top is made of sycamore and covered over with a permanent cover, worms will not be long in making their appearance, and also in the side-rails of tables and bedsteads, or in fact for whatever purpose the wood is used, if it is not exposed to a certain amount of friction, it will sooner or later be destroyed by worms.

On the other hand, the sycamore wood excels any other for the construction of the large rollers that are used in the manufacture of cloth, which makes the wood in this district; if you can get it sufficiently long, and over 20 inches in the quarter girth, more valuable than any other English-grown timber. For any other description of rollers, sycamore excels all other wood. For the manufacture of kitchen tables or such other articles that would be scoured or washed occasionally, sycamore is suitable, but I cannot agree with that part of the quotation from the book where it reads that sycamore "*is not subject to be worm eaten.*"

R. Jandrell,

Hawkstone, Salop. *Forester, &c.*

P.S.—If you wish I could send you a report of the conifers that we have here. I believe they are not to be easily excelled in Britain. [Do. Ed.]

PLANT PATHOLOGY.

Sir,—The presence of fungi in decaying timber indicates only the effect of the cause, and must not be confounded with the disease. No tree suffers from putrefaction, nor can a nidus for fungi be formed, until its living principle has become neutralized. When such takes place, whether from aridity or internal fermentation, Cryptogamia complete the work of destruction in the timber. The sap or life-sustaining element of growing trees is a substance of a highly organized nature, containing ingredients extremely susceptible to putrescency. A secretion from any of the constituents composing the sap will ferment and generate a sort of virus in the cells, which will soon form a receptacle for fungi. Fungi multiply on the geometrical principle, and a single spore insinuated in the intercellular tissue will, with their productive propensities, generate infinite numbers in a remarkably short space of time. I will sum up the cause of this disease briefly. 1st, the presence in the soil of something inimical to the tree; 2nd, when soils are deficient of the particular constituent which nourishes the tree; 3rd, when soils are shallow, and lying on impervious beds of clay, metalliferous ores, or igneous rocks; 4th, when soils are sour or not sufficiently drained; 5th, when thinning has been neglected and the pabulum exhausted; 6th, when the physical character of the plant is bad, by being raised on soil containing a preponderance of organic matter.

D. Sym Scott.

Ballinacourte, Tipperary, 9th July, 1877.

REMARKABLE YEW TREE.

Sir,—Since reading the interesting account of ancient yew trees in your last issue, I have carefully measured a grand old specimen growing on the Longleat estate, and perhaps a record of its dimensions may be acceptable to your readers. The site occupied by this veteran yew is a portion of Temple Farm Garden, Corsley, adjoining Longleat Park; and I may as well mention that it is indebted to the upper greensand formation for the sustenance which has been the means of building up so bulky a specimen of the vegetable kingdom. The measurements are—Height, 50 ft.; girth of butt at the ground level, 33 ft. 7 in.; do. at 1 ft. above the ground, 29 ft. 2 in.; do. at 4 ft. up (or the smallest girth), 24 ft. 5 in.; length of butt, 6 ft., where it divides into several limbs; the two huge central limbs girth 12 ft. 7 in. and 12 ft. 9 in. respectively; these latter, by a strange freak of nature, again unite at 6 ft. up, and are there grafted together in Siamese twin fashion; the diameter of spread of branches from north to south is 52 ft., and from east to west 57 ft.; and the circumference of the widest spread of branches is 168 ft. This fine old yew is still healthy and growing, its head is very dense and full of leaf. Viewed from one side, it exhibits a perfect pyramid of dark green foliage, being broad at the base and gradually tapering to a narrow top, but on looking at it from the opposite side, it is more shouldered, and presents a flatter and more irregularly conical form. The butt, to all outward appearance, is sound and solid, and tolerably round, save above two of the large roots, where it bulges out slightly. The age of yew trees, growing under favourable circumstances, and when in healthy growth, may be approximately guessed by allowing 100 years for every foot in diameter of stem, therefore I should guess this tree to be not less than from ten to eleven hundred years old. I have recently grubbed out a quantity of shrubs that were growing round it, so as to encourage it to renew a lease of its life for another century or two, forked the ground over a spit deep under and some distance beyond its branches, and afterwards spread a good thick layer of road parings over the surface.

This I have no doubt will prove very beneficial to its roots, and promote its healthy growth for many years to come.

I also measured a group of six yew trees in Longleat Park. They are mere juveniles as compared with the old specimen above mentioned, still, they are very fine examples of tall, healthy, vigorous growing yew trees. They vary from 40 ft. to 55 ft. high, and girth from 6 ft. 1 in. to 7 ft. 11 in. round the stem at 5 ft. above the ground. The largest specimen, which is 55 ft. high, contains 78 ft. of timber. The soil in which they are growing is a rich loam resting upon a Kimmeridge clay subsoil.

G. B.

ITALIAN POPLAR.

SIR,—I have not had the May number of your Journal, and I have missed an article by Mr. McLaren, of Hopetown, on the Italian Poplar. Referring meanwhile to the remarks of "an Amateur" last month, I will, with your leave, state some particulars herein on the subject, such as have come under my observation during a pretty lengthened experience. It is a long time now since I began to cultivate the Italian poplar; I think I may surely claim the merit of having introduced it to the list of forest trees, and at any rate of having grown and sold it as such to a greater extent perhaps than any other single individual or firm in Britain at the present day. Thirty or forty years ago the larch, which had previously been grown here for all purposes and on all sorts of soil and situations without much discrimination, under the influences of our changed climate, began to show unmistakable signs of failure. It is now and has for many years past been discarded on most of the central or inland districts of Scotland. At this juncture the Italian poplar, as we have it here, seemed to me not an unworthy substitute, equal to the larch in my opiuion for various country uses, some of which I may mention hereafter. About this time an enterprising forester at Eglinton Castle, the late Mr. Robert Gardiner, took an interest in my hobby, and for several years had some thousands of it annually planted out on the estates there. These trees may now be seen, at least were by the writer within the last few years, growing amongst the covers in all directions, many of them from 70 to 80 and 90 feet in height, and from 12 to 15 and 16 inches through for 20 and 30 feet from the ground; any intelligent wood merchant or coal master coming across some lots of such timber laid out at the cover side, would not, I fancy, give himself much concern about the name. Your correspondent "Amateur" might have some difficulty in detecting virtue in the sticks; the wood merchant in all probability would see something more to his liking, viz., value.

Within the last six months I noticed lying in a nobleman's wood yard a log of wood squared and ready for the bench, which I found to measure 13 feet in length and 20 inches on the side from end to end. Being somewhat puzzled to make out its kind, I stripped off the bark. The forester, a man of great practical experience, seeing that I was interested in the stick, said at once, "That is the Italian poplar, and it is only a limb or branch of the parent tree." I was afterwards shown the same wood cut up for nearly all the estate purposes. I was particularly struck with some planks cut at about 24 feet in length by 10 inches in depth, as fine sound timber as could be desired, and for roofing quite as durable as any other.

Yours respectfully,

JOHN DYKES.

Kilmarnock,
20*th July*, 1877.

BLACK GAME.

SIR,—Will you kindly permit me, through the medium of your valuable Journal, to draw the attention of your experienced correspondents to the destruction of young Scots fir plants by "*Black game*," with the hope of eliciting some information regarding this subject from those who are situated in districts where this sort of game is plentiful; feeling confident that those who are able to give the desired information will be only too happy to do so.

The first question I would put is; Whether the destruction by black game of young Scots fir has been hitherto much experienced?

Second, whether anything is known to exist, or might be suggested, to effectually stop its ravages, other than the annihilation of the birds?

On first discovering that the young shoots of the plants were being destroyed, just as they were about an inch long, I very naturally felt some uneasiness regarding the matter, and set a vigilant watch until I found out that they were being destroyed by black game. I therefore immediately put myself in communication with those whom I thought to be in the best position to give the necessary information, but hitherto I have been unable to gather anything of much importance; and hence my application to the columns of the JOURNAL OF FORESTRY, where it occured to me I should have a better chance of obtaining the information I so much desire.

If this has been a thing known to exist for any length of time, I wonder very much that it has not been brought before the "Arboricultural Society" for a full discussion of the subject (and I am not aware of its having been brought up at any of the meetings of that Society). As this is a subject which must obviously interest all foresters alike, as I consider black game to be a greater enemy to young Scots firs than either hares or rabbits, seeing the amount of plants they will destroy in an almost incredibly short space of time where they are plentiful and in close proximity to young plantations.

Not having seen anything of this matter before, I am of opinion that the late season here in Argyleshire is the cause to some extent of these ravages by *black game*, which I am informed feed largely on "*sprouts*" on the hills, and these being late they were forced to the low ground in search of what food could be gathered.

I hope that I have not occupied too much of your valuable space, and that some of your correspondents may be able to give the much-desired information and suggest some remedy.

ROBERT MORE, *Forester.*

Hafton, Kiru, Argyleshire.

THE BITTER WILLOW.

SIR,—Would any of your correspondents kindly say whether they are able to recommend the bitter willow as a hedge plant? I am told its shoots are never eaten by stock, and that they are readily saleable for

basket-making purposes, but I should doubt how far it would be a fence sufficient to resist heavy cattle. If any of your readers who can speak from experience would kindly give me some information upon the subject, they would confer an obligation on A SUBSCRIBER.

17*th July*, 1877.

PRESERVING WOOD POSTS.

SIR,—It is to be hoped that something practical will result from the discussion on the best means of preserving gate and paling posts, as one cannot fail to be struck with the evident waste of material which is occasioned by six or nine inches of a post giving way at the ground level, while the upper and under portions of it are comparatively fresh.

We know that a post so affected for all practical purposes is useless, and has to be flung aside and replaced by another that is sure to fail in exactly the same way.

Now the thing that is wanted to remedy this is for some means to be devised in order to make a post of equal durability throughout, and if it is possible to make the neck of a post last as long as the top and bottom, the saving of labour and material would be immense.

By way of helping to solve this somewhat difficult problem, I would lay before your readers the following facts.

About three years ago I had about eight hundred yards of a five-barred paling to repair, the rails of which were good, the upper part of the stobs also were quite fresh, but almost every one of them was rotten quite through at the ground level, so much so that the wind at times threatened to blow the whole structure to the ground.

Now the usual way of fixing up a fence of this kind is simply to knock the posts off one by one, and put others in their places, an operation that generally breaks a number of rails before it is done. In the present instance, however, I did not do that, but after a little experimenting got some hundreds of iron prongs, which were driven in alongside and nailed to the decayed stobs. Two men went over the eight hundred yards in two days and a half, and the fence, as far as the stobs are concerned, will to all appearance stand for eight or ten years without needing further repairs. These prongs cost about 6¾d. apiece, which is cheaper than a larch stob, and one great advantage gained by their use is that a beech stob, which lasts on an average only two years, can be made, by having one of these prongs fixed to it, to last for ten years. In closing, I would ask if there is anything to hinder the heavier kinds of posts being treated in a somewhat similar way by having a substantial cast iron socket sunk in the ground with suitable bolt-holes at the top, to which the post could be firmly screwed? I should suppose that a post so fixed would last for fifty years, if care was taken to keep the bottom of it clear of the ground. R. BAXTER.

Dalkeith Park, 15*th July*, 1877.

THE CULLEN PRICES.

SIR,—Having been seriously ill and confined to bed for some time, I have been unable to reply to my contemporary anent his prices. If all is well I expect by next month to be able to give a brief and concise report, with authority distinctly quoted, as to the average prices paid by consumers in and around this neighbourhood, delivered free at their respective places.

Trusting you will find space for these few lines, and with due deference to all, it would be unbecoming on my part if I did not substitute for *ancora imparo* my address *bonâ fide*.

J. B. SMYTH, *Forester.*

Duff House, Banff, N.B.
18*th July*, 1877.

An Address delivered before the American Forestry Association,

By BURNET LANDRETH, Chief of the Bureau of Agriculture, Centennial Commission, Philadelphia.

The modern and doubtless correct idea of the road to perfection is by division and subdivision of labour, study, and investigation; hence we see lawyers devoting their professional attention to jurisprudence as applied to commerce, others to land titles, even to criminal practice, as it is called, in which latter it is sometimes difficult to determine which is the greater criminal, the culprit at the bar or the professional who defends him. In medicine, some apply themselves to surgery; with others, all their powers of investigation are directed to the eye, or ear, or clinics; and we naturally call to our aid when necessity requires those who have achieved reputation in the special department which suits our case. In agriculture the reverse seems to be the popular rule, and mixed rather than specific farming is generally advocated: probably the presumption is that, whilst preparatory study and practice are requisite to form an accomplished member of a "liberal" profession, men are farmers intuitively, and knowledge, whether of the soil with its chemical constituents, of cereals, of cattle, sheep, or swine, may be sufficiently understood without study or previous acquaintance. Never was a greater mistake; and the farmer who should uninstructed step behind the counter of a Stewart and direct the movements, would soon find his error, just as so many citizens have in the reverse case tested to their cost that there is no royal road to technical knowledge. It is not my purpose, however, to dwell on this phase of rural life—there is not one whom I address who does not realize the necessity of training preparatory to successful husbandry.

What I desire now in an especial manner to direct attention to is a branch of agriculture which until recently has been almost entirely overlooked by us. I of course refer to Forestry. Heretofore the way to get rid of timber at the least outlay of labour possible, seems in many cases to have been the object aimed at, and we have gone on in that insane effort until now; whilst we are still in our infancy as a nation, our country is made naked, and the sources of supply of valuable timber, either for shipbuilding, the mechanic arts, or fencing, are so remote that had it not been for premature extension of railroads penetrating the inmost recesses of the forests, prices would have advanced beyond any reasonable measure of values, and have seriously impeded the constructive arts.

If we turn our eyes northward, from whence the valuable white pine lumber is exclusively obtained, we find that many thousands of acres which only a few years ago, comparatively, were covered with dense growth of this invaluable timber, have been cut off; and they who cater for the timber market have receded almost out of sight, ere they can find further supplies. Maine, once by way of distinction termed the White Pine State, is now denuded; and mills erected for manufacturing pine lumber are content to saw spruce logs less than a foot in diameter; and to-day, were it not for the paralysis which has seized on industry, the price of white pine would be at least several times greater than ever known within the memory of those whom I now address.

The same condition of affairs applies to hemlock, one of our valuable American trees, which, like the buffalo, is recklessly slaughtered for its hide, until shortly it must cease to exist upon our continent, unless the practice of this generation be radically changed. How sad to know that the noble hemlock isthus ruthlessly cut down for the simple bark which encases it—itself, many times left to lie and rot, a monument, perishable fortunately, of the profligacy of man, who, to supply a present want, recklessly destroys that which should be the invaluable heritage of his children.

Now where is all this to stop? Legislation cannot be invoked to correct the evil. A man has a right to do in these particulars as his ideas of private interest prompts; and unless by moral suasion, and the argument be successfully enforced that he is killing his own goose which is laying golden eggs, the error will doubtless go on to the bitter end, until every primitive tree within reach of market has been laid low, disregarding the fact that the annual increase in cubic contents and the certainty of enhanced prices present the best investment the present money values could be placed in. Fortunately, those of us who reside upon the seaboard have a resource not likely to fail; and the more especially in view of the large areas of once tilled land now being re-clothed by forests. I refer to the Southern Pine, of which there are several species, each of value in the departments of the coarser arts.

Those who less than a quarter of a century ago traversed our seaboard, beginning at Portsmouth, Virginia, and extended their route through the Carolinas, Georgia, and onward, could not fail, it is said, to be forcibly impressed by the apparently interminable forests of this valuable timber—stately trees in absolutely countless numbers—each representing a value which to a northern eye could be as surely estimated as the sheep on the hill-side, or the cattle on the broad prairies. Alas! in most cases the denizens of these roadside forests have disappeared; and he who now makes the journey to which I have referred will find on tens of thousands of broad acres only the blackened and charred stumps of those once stately trees—the needs of the passing hour having compelled their improvident owners to convert them into ready money. We have only, however, to advance inward, westward of the coast-line a few miles, to find ample store of similar timber, which lateral railroads are piercing; paving the way, as it were, towards the marts of the great cities. Happily to restore the ex

haustion of yearly demands acres upon acres of corn and cotton fields, worn out by reckless tillage, and abandoned by the plough, are being re-clothed by nature, to be sources of supply of yellow pine timber of immediately succeeding and future generations. *For this special variety nature is thus making ample provision.* So readily does it, the yellow pine, make itself at home in light or sandy soil, that within the memory of man the lower county of Delaware, and the peninsula bounded by the Chesapeake and Delaware Bays has been made the favourite locality of the common yellow pine, which has attained sufficient dimensions within the period referred to, to be cut for saw-logs,—and this in a district of country where previously pine was absolutely unknown, the forests being exclusively of hard-wooded trees. But we need other than yellow pine lumber; good as it is, it does not supply every want, and unless the science and practice of forestry be taught those wants are destined to go unsupplied. It is to this special point I desire to invite attention, and in connection with it, and the subject of white pine in its northern habitat, I will here relate a fact which may, I feel confident is, destined to exert an important influence on the future sources of supply; indeed, I do not hesitate to predict may prove the starting-point to interests of fabulous extent, in the light of which cotton itself as a product exclusive to the south, may lose somewhat of its lustre. A gentleman of Virginia, a friend of mine largely interested in lands, a shipper of timber from the seaboard, therefore not inexperienced, discovered in his forest explorations what, for want of a better term, I shall call *a white pine settlement*, in the dense yellow pine forests of the northern neck of his State. In the midst of a group of white pines, extending over an area of five or six acres, stood a gigantic individual tree, ninety-six feet high, eight feet four inches in circumference three feet from the ground. There it stood and stands to-day, surrounded by seedlings from forty feet high down to seedlings of a year old, as the boundaries of the settlement are reached, numbering in the whole three to four thousand.

Here is a fact which cannot be questioned. It is like the testimony of the rocks. A bird of passage had evidently dropped a solitary seed at some period long preceding, which springing up had established itself in its new home, far distant from the region where nature had placed its ancestors. The mere fact itself of a white pine having fixed its abode and prospered in a remote locality is but a trifle—a circumstance of but little practical significance; but taken in connection with inferences not to be ignored, its value can hardly be over-estimated. The proof is made patent that this tree of northern habit thrives equally well with the southern pine (of which there are several species, commercially classed as Carolina) in the latter's native sand, and under the scorching sun of the south, opens a vista in forest tree planting, which those who look beneath the surface cannot fail to appreciate. *It is the index to future wealth of inconceivable magnitude.*

In the science of forestry trees are divided into two distinctive classes—one called *encroaching*, which perpetuate and increase themselves under favourable conditions; the other *receding*, which disappear before the

advance of civilization. To the former of these the white, like the yellow pine, evidently belongs, a very important circumstance in connection with its proposed culture.

Already I have the satisfaction to announce, and desire the fact be placed on record, that my firm which is interested in forestry has embarked in the planting of the white pine on the seaboard of Virginia, and though the time is too short to state the actual success of such plantations, there is every reason to expect good results. If the question be asked, why plant white pine when the yellow springs up indigenously, spontaneously on every abandoned corn-field of that region ? The answer is simply, because there is no present possibility of a short supply of the yellow, and the white is under all conditions worth double the money in the market, and produced on the seaboard can be transported by water at immeasurably less cost than from the far north ; beside, land without undergrowth, thus ready for planting, can be purchased at small cost ; and it affords a prospect of recuperation for that section which no other industry presents. In a patriotic aspect it is therefore worthy of attention. Tens of thousands of acres, hundreds of square miles of worn-out corn and cotton lands lie contiguous to the sea, whilst their owners stand with folded arms waiting for something to turn up. These lands won't pay for tillage in grain, and grass for pasturage is not enduring. To buy fertilizers is out of the question, and it is cheaper to emigrate to the rich bottoms of the Mississippi, where cotton is the desired staple.

Whilst the broad prairies of the west and the natural grass-fields beyond the Missouri and on the Pacific coast invite the immigrant from abroad, and the native seeking a new home, the south is likely to be overlooked. What then is to be done ? Re-clothe the abandoned or at least neglected lands with forests, as in the days of the early English settlers, and the whole scene will have changed ; prosperity will once more visit that region, and with accrued capital, better systems of tillage, and free schools established at every cross-road, sectional differences will disappear, and we shall be henceforth a united people. In Europe forest culture—the planting of forests for timber—as all present know, has been long successfully pursued ; and the practical processes are taught, I believe, at all the agricultural schools. Long ago, however, ere such colleges were established, no inconsiderable progress had been made in that direction by owners of large estates, notably in Scotland, where larch-planting was introduced in 1738, by the Duke of Athol, and so successfully prosecuted as to be familiar to you all. In Germany and France similar progress has been made ; artificially formed forests being met with on every hand, the developed pines, spruces, and firs planted at uniform distances, and possessing symmetry of growth, the branches interlaced far overhead, reminding one of the pillars of some stately cathedral. Now what I desire on the present occasion is simply to drop a few hints which may induce reflection. I aim only at so much, not to instruct, for I am myself a student. If anything which I may say shall be found to bear fruit hereafter, I shall be compensated. Among other things I wish to start the inquiry whether in our classifica-

tion of agricultural instruction the time has not come to teach *forestry* as a science—I say science because it is susceptible of exact results:—whether, in the subdivision of rural interests, the practice of tree-planting should not be clearly recognised among the present and prospective industries of our people. Of course it is not to be supposed for an instant that all localities are favourable, alike promising profit. The manufacturer, when he determines to locate his works, seeks the point either where a ready market may be found, where the raw material is readily obtained, where fuel for steam-power, or where water-power is at command; some one or more of these conditions are indispensable to success. So he who plants forests must use proper discrimination, or he will find either the accumulated interest on land, or the cost of reaching the market for his lumber, may eat up the natural accretion of a generation's growth. So, also, the planter must study the adaptation of special trees to his soil, exposure to climatic changes, time which he can afford to await returns, and other circumstances incident to the enterprise. He must study, and carefully study too, the methods of procedure: the gathering of the seed and its preservation until sown, the proper time and method of sowing, whether it be in seed-beds, under sun-screens (the young plants to be subsequently transplanted into nurseries preparatory to being permanently planted out) or, as in the case of oaks, walnuts, chestnuts, and trees of similar character, the seed to be planted in the field, or mountain-side, to remain undisturbed. In all these processes there is so much skill requisite, technical skill only attainable by practice and observation, that it will at once occur to the reflecting farmer, or cotton planter, that he is probably unprepared to embark in the enterprise. Having been convinced of that fact he has already taken the first step towards success; the next will be, if he decides to plant, to employ the service of an *expert*—a class of men in this branch of industry not readily obtainable in this country. What then is to be done? Do not start till he is ready to send his son to an agricultural school, where he may be taught the whole a b c to z, the alpha and omega of forestry. Whilst studying *that* he will acquire knowledge of natural science, and other information invaluable in rural life. I am aware that agricultural schools under the patronage of State governments have not been uniformly successful; indeed, it is only candid to admit that they have in some cases, that of our own State of Pennsylvania included, been sad failures; but should we not profit by our experience in these particulars, and henceforth, like the skilful mariner, avoid the shoals? There are, however, opportunities extant for instruction, and it is our province to provide others without delay; failing such, under special circumstances, the entering a youth for a term as a pupil in a well-conducted nursery may accomplish all that is contemplated. In such an establishment he could, in two years at most, be initiated into the art and mystery of rearing trees from seed, the processes of culture, their care, preservation, and transplanting; and if he were of an investigating, inquiring mind, he would acquire visions of nature which have never entered into the view of multitudes who take rank as successful farmers.

In England it has long been the practice of the commercial and manufacturing classes in search of greater security for their acquisitions than trade presented, and, perhaps, also in some cases to take rank as country gentlemen, to place sons with well-educated, accomplished farmers, to be instructed in the practical details of husbandry, preparatory to taking charge of landed estates in their own interest. May not that plan point out a method of teaching forestry, where competent men may give instruction in that especial branch, as well as in other pursuits of rural life—schools under the refining influences of home ?

In days gone by it was the practice of southern planters to send one of their sons to the medical school at the Pennsylvania University, or Jefferson College. Here they passed two winters in attendance on the lectures, returning home with diplomas in their pockets, not in most cases to practise medicine as a profession, but prepared to minister to the wants of the plantation hands and household servants. It might be difficult to estimate the influence on the intellectual character of an isolated rural community where one of these young men found his abode, imperfect as his education may have been, compared with the great field of knowledge unexplored. Now, in recommending farmers with the necessary means to send their sons as students to nurserymen, it is not with any expectation they adopt the nursery business as the pursuit of life, but simply to qualify them for the more profitable enjoyment of their paternal acres, to expand their views beyond the boundaries of the homestead, to occupy the high position which is an American farmer's birthright.

I trust this convention may be the forerunner of others, that a complete organization will be established, that subjects for essays to be read at subsequent meetings may be determined upon in advance, and that its influence be extended at home, and conference be had with kindred associations abroad. I beg leave to lay upon the table of your chairman my credentials as a member of the Scottish Arboricultural Society, and as that Society's representative at the Centennial Exposition.

Remarkable Silver Firs.

In writing upon the silver fir in the *Garden*, Mr. Berry makes the following remarks on some very fine old specimens :—At Longleat, Wilts, there are some remarkably noble clumps of this tree growing on directly opposite conditions of soils. The oldest and tallest specimens (probably the largest in England) are growing in a clump in the park ; the soil in which they are growing is a rich hazel loam and Kimmeridge clay subsoil ; the clump consists of nine trees, and they vary from 105 ft. to 141 ft. in height, and girth at 5 ft. above the ground from 10 ft. to 15 ft. 2 in. ; they are quite matured,—indeed, some of them are becoming decayed, and one or two have withered tops and a great many dead branches. I am unable

to give the contents, as it would be dangerous to attempt to climb up amongst the decayed limbs; it is said the highest tree in the clump (its top is now dead and some portion of it broken off) was 150 ft. high about twenty years ago. The clump stands in an exposed situation, on an elevated piece of ground on the confines of the grove, and forms an apex to the latter famous collection of fine old timber, standing out in bold relief as a landmark so far as the eye can reach from prominent heights in the surrounding country. Another clump of magnificent trees is growing in an oak coppice adjoining the park; the soil is a stiff loam on the Oxford clay. Six of the largest trees in this clump measure from 116 ft. to 129 ft. high, and girth at 5 ft. up from 13 ft. to 15 ft.; at 30 ft. up they girth from 10 ft. 7 in. to 12 ft. 3 in.; and at 60 ft. up girth from 7 ft. 3 in. to 8 ft. 5 in. The average cubical contents of six trees is 465 ft.; the largest tree 517 ft. The whole of these trees are beautiful healthy specimens, full of vigour and growth, and are branched quite near to the ground. The next clump I will mention is growing on a thin poor soil on the greensand, and it was probably planted about the same time as the last-mentioned clump. Twenty of the largest trees in this clump measure from 95 ft. to 114 ft. high, they girth at 5 ft. up from 9 ft. 10 in. to 14 ft. 3 in., and the contents of each tree varies from 240 ft. to 345 ft. These are all healthy trees and well furnished with branches near to the ground, forming a large, bold, and effective clump, situated on the verge of an open valley, with hanging woods on either side, and when viewed from the summit of hills in the vicinity, form a striking feature in this wild ornamental portion of the estate.

At Strathfieldsaye, Hants, there are some fine specimens of the silver fir, upwards of 140 ft. high, and girthing at 5 ft. up from 11 ft. to 13 ft. 6 in. At Springkell, in Dumfriesshire, there are some remarkable silver firs. Twelve of the largest trees measure from 80 ft. to 115 ft. high, and girth at 5 ft. up from 10 ft. 8 in. to 13 ft. 9 in.; their cubical contents varying from 180 ft. to 520 ft. In many other parts of Britain fine specimens may be seen, but I hardly think that there are any to be found that will exceed the measurements of those I have given.

A few years ago a silver fir at Southwick, near Colvend, Kirkcudbrightshire, was 159 ft. high, 16 ft. 10 in. at 3 ft. up; and another on the same estate 134 ft. high, with a girth of 15 ft. 3 inches. Besides these, there are several other fine silver firs on the Southwick estate above twelve feet in girth. They are growing in a deep loam in a sheltered position.

On the estate of Edinbarnet, Old Kilpatrick, Dumbartonshire, a county noted for tall trees, there is a silver fir in vigorous condition 150 ft. high and 12 ft. in girth at 3 ft. up. On the Rossdhu estate in the same county there are two silver firs, growing at an altitude of 230 ft. above the sea; one 110 ft. high, girth 16 ft. 2 in. at 1 ft. up, and 12 ft. 6 in. at 6 feet up; the other 102 ft. high, girth at 1 ft. up 17 ft., and at 6 ft. up 13 ft. 6 in. There are also two very fine trees on the Roseneath estate, the height of one being given by J. C. Loudon in 1840 as 124 ft., with a diameter of trunk 6 ft. 4 in. at 3 ft. from the ground; giving a circumference of about

25 ft., considerably more than any other silver fir that we are aware of, and certainly one of the largest, if not the largest in Britain.

In many parts of Scotland, in deep rich soils, and moderately sheltered situations, silver firs are to be found ranging from 110 ft. to 120 ft. high; their weatherbeaten heads towering high above all other trees, and forming a very marked and distinct feature in a wooded landscape; and it is said that they reach a still greater height in some parts of England and Ireland than any we have mentioned, but of their dimensions we have not yet seen any authentic particulars. A famous silver fir in Woburn Park, Bedfordshire, is recorded to have grown for 110 years at the rate of one foot in height per annum, and added to its contents at the rate of nearly three and a half cubic feet annually.

Insects Injurious to Trees.

The large Red-belted Clearwing (*S. culciformis*) is a wood insect, the moth depositing its eggs on birch stumps, though it will attack growing trees: it is similar in habit to its brethren. Also red-banded as well as red-tipped is the Red-tipped Clearwing (*S. formicæformis*), not uncommon near London amongst the osier beds on the upper Thames. The moth is abroad at midsummer. The caterpillar lies hidden in the pith of various species of Salix, liking best small twigs. Though it has been reported as prolific enough to be injurious to the osiers in some years, I have never heard of an authenticated instance of recent date. In point of fact, none of the Clearwings are particularly prolific, and one or two species have been less common than formerly. Passing several rare and local species we come to the couple of Hornet Clearwings (*S. bombiciformis* and *apiformis.*) The latter, which is the most frequent of the two, bears so close a resemblance to the hornet, that each summer it alarms a number of nervous people; it is also able to produce a humming sound. But it is quite harmless, nor does the caterpillar do very material damage to the poplar, though it sometimes attacks saplings, feeding unseen for nearly two years. *S. bombiciformis* in the larval condition resides within the branches of sallow or shoots of the osier.

In the family *Zeuzeridæ* there are only three British species, two of these being important from the destructive effects they produce upon trees. The large Goat Moth caterpillar (*Zeuzera cossus*) is often to be seen at the heart of some willow or poplar, which has on account of its unpromising condition been doomed to the axe, and occasionally at early morn a caterpillar may be seen taking an excursion from one tree to another. Despite its size, the Brown-winged Moth is seldom noticed, though it rests on the trunks of trees in the daytime, for its colour harmonizes with the grey or brown of the bark. Every female killed before oviposition has taken place is a gain in a park or plantation, as thereby

hundreds of larvæ are stifled ere birth, and as the caterpillar life lasts two or three years, the quantity of wood a single individual can devour or damage is considerable, though it will seldom happen that one caterpillar can effect the ruin of a tree. And under all circumstances it should be remembered that the mischief done is not solely traceable to the jaws of the caterpillar of the Goat Moth, for the air-holes it pierces as it grows large admit rain and frost to the heart of a tree. The disused mines of the Goat caterpillar are besides taken possession of by other insects, notably by the larvæ of a beetle called *Scolytus destructor*, which is often reputed to be the destroyer of elms, when it is only the finisher of a mischievous work done by the far larger Lepidopterous larva just named. In certain states of the weather the peculiar smell that suggested the name of Goat may be perceived some short distance from the trees haunted by the caterpillars. Many wonderful narratives have been published descriptive of the muscular force that the Goat caterpillar is endued with, and after the accounts of its biting a hole through a sheet of lead, and upheaving a tumbler on which rested a book weighing several pounds, we are prepared to credit it with any feat. The horny flattened head at once suggests great strength, and its movements are aided by a horny plate on the next segment, while each succeeding segment has a formidable array of muscles.

The Leopard Moth (*Zeuzera æsculi*), less in size than *Z. cossus*, is too well known as an enemy of trees, attacking the branches as well as the trunks when a larva, and in our London suburbs it has wrought the ruin of many an elm, horse chestnut and laburnum. I have also seen more than one acacia killed by it; and the late Edward Newman, long ere his decease, was convinced that the opinion he once expressed in print, that the Leopard Moth did not destroy fruit-trees was an erroneous one. In some districts of Kent and elsewhere the larvæ have wrought sad havoc amongst young ash trees grown for use as hop-poles. But it does seem, as stated by Newman, that in various instances pear and apple trees which are infected exhibit a kind of spasmodic activity, and for a time bear more fruit. An array of black spots on the back enables us to distinguish the caterpillar of *Z. æsculi* from the livid-coloured *Z. cossus*: in other respects excepting size they resemble each other.—*C., in Journal of Horticulture.*

Eucalyptus Globulus in Jamaica.

Reporting on the growth in Jamaica of the now widely known blue gum tree of Tasmania (*Eucalyptus globulus*), the superintendent of the Botanic Garden says:—It is only a little over six years since the seeds of the plant were introduced. Several hundreds were thus planted at the Cinchona plantations, and they have since attained a height of about 60 feet, with a trunk measuring a foot in diameter near the ground and six inches at a height of 20 feet. During the past year 3,000 plants of this tree were distributed, in addition to 2,000 in the previous year.

The great majority of these were sent to the lowlands, where, however, except in a few instances, they have not succeeded. It seems pretty well established now that this tree, contrary to popular belief, is not adapted to the lowlands of the tropics. On the hills, however, as above indicated, it grows with remarkable rapidity. The value of this plant on the hills, consists in its importance as a timber tree, as it is not only one of the most durable and useful woods, but it grows with greater rapidity and to a larger size than any other known timber tree. Judging from the rate of growth attained by plants introduced six years ago, trees two feet in diameter are certainly producible in ten years from seed. Its perfectly straight trunk and great length further augment the yield of timber. It possesses another advantage, namely, the branches are not wide-spreading like most other trees; hence, in forming a plantation, the plants may be set unusually thick. Compared with the growth of any other useful timber tree in Jamaica, there is no doubt that the blue gum is capable of producing several times more wood in an equal space of time than, for instance, the Jamaica cedar (*cedrela odorata*), which is probably the fastest-growing Jamaica timber tree as it is the most useful, but it would require double the time to produce the same quantity of wood.

The lowest altitude at which the *Eucalyptus* should be planted in the tropics is probably 2,000 feet. It is, therefore, greatly to be desired that some of the bare grassy hills of Jamaica should be planted with this invaluable tree. It seems anomalous that in a country where land is of so little value, and vegetation so luxuriant, nearly all the timber used for building purposes should be imported, the imports amounting annually to about eight million feet of timber and five million shingles, much of which is even carried to the interior of the island.

These remarks will be read with interest, coming as they do from one with the practical experience of the superintendent of the Jamaica Botanic Garden.

The Preservation of Timber.

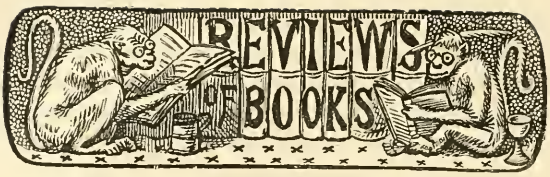
Buried in the earth or exposed to the air, timber rapidly deteriorates, and undergoes the species of decomposition known as dry-rot. This decomposition may be retarded by the application of a coat of paint to the timber exposed to the air, or by carbonizing the surface of that which is intended to be sunk in the ground.

During the last twenty years several methods have been tried for making timber more durable, the principle of which consists in expelling the sap remaining in the ligneous fibres, in order to replace it by chemical solutions, such as sulphate of copper and creosote; but these processes, comparatively costly and only partially successful, do not entirely accomplish their object. Starting from the fact that oak, chestnut, and certain American trees resist the action of air and damp better than others, and that they owe this property to the tannin which they contain, a chemist

proposes to tan the timber by substituting for the sulphate of copper and creosote a compound of tannic acid and iron. The object of injecting various substances into wood is to poison them, so that germs and microscopic growths may no longer live and propagate either on the surface or in the interior. Now tannin is one of the most active and certain destroyers of germs both vegetable and animal, which fact accounts for its preservative agency. Besides, it is to tannin that is due the almost indefinite preservation of leather. One peculiarity to be noticed in this process is, that timber treated with this compound of tannin and iron, that is to say a composition similar to ordinary writing ink, is turned black.

The process of injecting timber with tannate of protoxide of iron is due to M. Hatzfeld; the Eastern Railway Company of France has experimented with it on some sleepers, and the Telegraphic Department on some posts.

M. Boucherie has denied in a note to the "Academie" the efficacy of this process, contending that the attempts already made to preserve timber from dry-rot by injecting it with iron salts have yielded only partially successful results, while sleepers treated with sulphate of copper have lasted twenty-five years and more. Reply is made to these objections by quoting—not the experiments of the laboratory or the workshop, but those made by time itself. It is not a rare circumstance to encounter in earth of a ferruginous nature the trunks of very old oaks, blackened and very perfectly preserved; at Rouen, in 1830, some old oak paling was discovered as black as ebony, and dating back to the Middle Ages. Not very long ago, too, Norman vessels built of oak were discovered in an almost perfect state of preservation in the neighbourhood of an iron mine in Norway. It is more than probable that the preservation of the oak under these circumstances is due to the tannin contained in the wood; it follows, therefore, that by introducing a substance rich in tannin into timber that does not naturally possess it, its resistance to decay is increased.—*Journal of the Society of Arts.*



Cultivated Plants: their Propagation and Improvement. By F. W. Burbidge. Edinburgh: Blackwood and Sons.

This eminently practical and suggestive work will supply a want that has been much felt by all cultivators of plants in acquiring a correct knowledge of the best means of propagating them, so as to enable them, with some certainty of success, to increase their stock to any necessary extent, more especially of the newer and rarer sorts. Of such useful information, and practical suggestions for the improvement of plants, this work is brimful; and we feel confident, in recommending it to the favourable notice of our practical readers, that they will acquire a vast amount of useful knowledge and interesting information by a perusal of it. The propagation of useful and ornamental trees and shrubs, especially of rare and curious species and improved varieties, is a subject to which foresters have devoted comparatively little attention, and we consider it to be as important and necessary a branch of their practical or technical education as the knowledge to a gardener or nurseryman of how to strike cuttings, bud, or graft.

No forester can be called thoroughly qualified to fulfil all the duties of his profession who has not a practical knowledge of the methods best adapted to increase the plants under his care, and we trust yet to see some efficient means taken by those who have the power to properly educate our young foresters in this very important part of their profession, as well as in all other technical matters relating thereto.

In reference to the raising or propagating of *Coniferæ*, the most important family of plants cultivated by foresters, excellent advice is given upon the selection of seeds from trees in the full vigour of their life, which has been found by carefully worked out experiments to be between the ages of 50 and 125 years, during which the rate of fertility of the seeds produced is by far higher than at any earlier or later period in the life of a conifer. As a rule, seeds collected from healthy, vigorous trees produce an equally healthy and robust progeny.

The author then proceeds to say, "The latter end of March, if mild, or the beginning of April, is the best time to sow all Conifer seeds; and it is an excellent plan to place the seeds in a bag, and to soak them in water for a day or two, taking care to dry the seeds in the sun before sowing.

The rarer sorts are generally sown in pots, pans, or boxes of rich moist earth; and the protection of a pit or frame is given them until they have advanced in growth sufficient to be pricked out in lines in the nursery beds. The more common and hardier kinds are, however, sown at once in nursery or seed beds a yard or four feet wide. The richer and more friable the soil the better; and the depth at which the drills should be drawn must be regulated by the size of the seeds, say from half an inch to one inch, which in the case of the larger and stronger kinds will be amply sufficient. If these seed beds are sheltered by hedges of Yew, Juniper, Privet, or Beech, so much the better. The seedlings may be lifted in about a year after they are sown, or in the April following, and pricked out in lines six or eight inches apart, leaving a space of about an inch between each seedling plant; and plants so treated will be found to have made considerably more progress than those left thickly in the seed-beds for two years, an old-fashioned plan still largely practised. As a rule, seedling Conifers should be lifted every year they are in the nursery beds, or until they are planted out in permanent positions in the woods or ornamental grounds.

"If seeds are not obtainable, the next best mode of propagating Conifers generally is by cuttings, which should be selected from the side shoots when the sap is in full motion. They should consist of branchlets of last year's growth, say from four to six inches in length, with a heel of the old wood, which causes them to root better. *Retinosporas*, *Taxus*, *Thujas*, *Thujopsis*, *Wellingtonias*, *Cedrus*, *Cephalotaxus*, *Cryptomeria*, *Dacrydium*, *Podocarpus*, *Cypress*, *Libocedrus*, *Torreya*, and many other well-known Conifers, are readily multiplied by cuttings like those above described. The usual practice is to insert the cuttings or slips in pots, pans, or boxes of light sandy compost, and place them in a cool and shady frame at the back of a north wall, or in a spot with a northern aspect. Seed is undoubtedly the best method of propagating all Conifers when it is obtainable; and cuttings, properly selected, are better, as a rule, than grafted plants, as the latter often throw out lateral leaders instead of terminable or erect ones, and these spoil the symmetry of the plant. When the central leaders of Conifers do not start away freely, the lateral branches, especially those which show a tendency to grow faster than their neighbours, should be shortened in about October; thus throwing fresh vigour into the leader and preserving the symmetry of the tree. Many propagators who bud roses or graft fruit-trees with every success, flinch at operating on Conifers, and this without any apparent reason, except that the plants are a little different in appearance; and this mode of propagation is rarely resorted to except in trade collections. All Conifers, if not too resinous, may be grafted as easily as a plum or pear tree. Scions or grafts are selected from the last summer's growth, and are grafted on stocks of the same or nearly allied species all through the winter months, in a pit or frame, in a genial heat; the stocks being seedlings or cuttings grown in small pots for the purpose. Terminal grafting is practised in the spring, taking the scions from the tips of the main branches when in a soft growing state. If in the open air the

operation must be deferred until the sap commences to move. Nearly all the species and varieties of *Picea* and *Pinus* are best propagated from grafts when seeds are not to be had. The Silver Fir, *Abies* (*Picea*) *pectinata*, is an excellent stock for all the finer varieties of Silver Firs. The numerous species of *Pinus* grow well on stocks of the different types which they most nearly resemble. For example, those species and varieties which resemble the common Scots pine (*Pinus sylvestris*) grow well on that species as a stock, but still better on *P. Austriaca*; while *P. Monticola*, *P. Lambertiana*, and their allies do best on *P. excelsa*, or on the Weymouth Pine (*P. strobus*), and *P. pinaster* is a good stock for *P. lemoniana* and allied kinds. Nearly all the Abies or Firs take kindly on the common Spruce as a stock; while Biotas and Thujas, as a rule, succeed well on the Chinese Arborvitæ, *Cupressus Lawsoniana*, which is easily raised from seed, and is of a clean free habit, forms an excellent stock for the different species and varieties of Cypress. *Pseudolarix Kæmpferi* is best propagated by grafting scions on its own roots, moderately thick pieces well furnished with fibres giving the best results. This mode of grafting may be used with advantage in the case of other rare Conifers which are difficult to propagate by cuttings.

"Grafting is largely practised in most of the trade collections of Coniferæ, especially for the multiplication of variegated or distinct varieties of any species. Some cultivators object to grafting specimens of Coniferæ; but while acknowledging seedlings to be decidedly preferable as a rule, one cannot gainsay the evidence afforded by the fine grafted specimens worked by Mr. Fowler at Castle Kennedy, and other well-known cultivators of these useful and highly ornamental plants and trees."

Upon the oak, ash, beech, birch, elm, lime, maple, poplar, chestnut, walnut, holly, thorn, rhododendron, and all other trees and shrubs cultivated either for their useful or ornamental properties, similar instructive details are given of the best modes of propagating them, and many excellent suggestions made for the improvement of their varieties. The work is rendered additionally attractive and instructive by many well-executed woodcuts illustrative of the text, and showing the method of performing some of the operations described, in a much clearer and easier understood manner than mere words could do. An excellent and comprehensive index is given of the contents of the book, and on the whole, for a first edition of a new work, seldom so much praise can be bestowed, and so little fault found.

The Eighth and Ninth Annual Reports of the Noxious, Beneficial, and other Insects of the State of Missouri, U.S.A., by CHARLES V. RILEY, State Entomologist, St. Louis, Mo. These valuable Reports for 1876 and 1877 have just reached us, and contain nearly 200 pages each of carefully worked out details of the important work performed and investigations conducted by that skilful and indefatigable entomologist, into the life, economy, and history of the various destructive insect pests which of late years have proved such a terrible scourge to farmers and others in Missouri, and

throughout most of the United States. In the reports before us much valuable and interesting information is given about that determined foe to the potato, the Colorado beetle, the expected appearance of which in this country is causing so much commotion amongst our *savans* and agriculturists. To the latter it may prove a very serious matter should the beetle unfortunately get established in their potato fields, and a careful perusal of these reports would better prepare them to meet and successfully combat the enemy, should his unwelcome presence in the country become an established fact, in defiance of all precautions taken to prevent his importation from the West. Interesting details are given of the great amount of damage done by it in the States in the past and former years; its origin in Colorado, and its migration eastwards; the enemies it has amongst insects, birds, &c.; and the best remedies for destroying it,—an application of Paris green being recommended as the most effective remedy yet discovered.

The "cankerworm," and a numerous army of other "worms," which are the cause of an infinite amount of damage to various crops or plants in the States, are all treated of in the same able and exhaustive manner. Full and elaborate reports are also given upon the life, history, and devastations committed upon vegetation by the "Rocky Mountain locust," which is one of the most terrible insect plagues that infest the Western States. During recent years whole tracks of country, as large as Ireland, have been devastated by this voracious pest, to whose devouring maw, it seems, no green vegetable matter comes amiss, and which in the course of a few hours changes the luxuriant verdure of spring into the desolation and barrenness of winter. Throughout the whole district overrun by them fully three-fourths of all the crops are destroyed, so that we may be thankful we have the wide expanse of the broad Atlantic between us and such a destructive pest, which, from climatical reasons, is not likely to pay us an early visit.

A great amount of attention is also devoted by Professor Riley to the "vine phylloxera" and its congeners on the oak and other plants; and during his skilful and laborious investigations he has elicited a vast amount of information, which is of great value to the owners of vineyards in the various countries infested by that deadly scourge to the vine-grower.

When shall we see such a thoroughly practical and skilful annual report as this made upon *British Insects* by a British State entomologist?

Tree Planting and South African Forests.

THE subject of tree planting is one that is at present attracting considerable attention in the Cape Colony. Every country that is subject to periodical droughts is too poor to neglect planting; in this point of view it is absolutely necessary to utilize every possible means of increasing rainfall and retaining moisture. In old Dutch times at the Cape a law required every landed proprietor to plant a certain number of trees per morgen, and as a consequence Capetown and Stellenbosch are now supplied with noble oaks, stately avenues, and shady walks. It must be admitted, on the other hand, that in the eastern districts of the Cape Colony tree planting has been shamefully neglected. We are glad, however, to be able to report that in this respect a change is taking place. The Divisional Council of Albany has resolved to plant the sides of all their public roads with trees. The city of Grahamstown has been immensely improved by judicious planting, and everywhere—in villages and at farms—tree planting is in course of being carried out successfully.

While writing upon this subject it may not be amiss to give our readers some information about South African natural forests. These are far more extensive and far more valuable than is generally supposed. In the George, Knysna, and Humansdorp districts there is a great forest of magnificent trees, in which in very many places the foot of man has never trod. Elephants still live there in a wild, untamed condition, and it was near the Knysna that Prince Alfred was successful with his rifle against these giant animals. Good timber is exported both from Plethenburg Bay and Knysna. Then there is the fine forest at Alexandria (Oliphant's Hoek), distant only thirty miles from Grahamstown. A belt of jungle and forest extends from Port Elizabeth inland to a distance of about sixty miles, with an average breadth of twelve miles. The Zumberg is in the centre of it, and elephants are frequently seen from the road to Somerset East, which crosses these mountains. In the kloofs or deep ravines of the Amatolas, and generally throughout Kaffraria, there is large timber. The most common tree is the "yellowwood," of which there are several qualities. Inferior yellowwood warps very much. Strukwood makes excellent furniture; iron wood is used for axles, and is so heavy that it will not float in water. There are fully a dozen varieties of really good wood which can be utilized in different ways. Some of them are close-grained, hard, and take a good polish. Among the resources of South Africa which have yet to be properly utilized are her forests, and the land in and around them.

In the neighbourhood of the Knysna, which is an excellent little seaport nearly equidistant from Capetown and Port Elizabeth, a settlement of

agricultural farmers ought to answer very well. Beautiful scenery, good land, a forest of fine timber, and a magnificent Italian climate, are among the advantages. Certainly the Government of the Cape Colony ought under their land and immigration policy, to provide inhabitants for such districts.—*South African Mail.*

Amputation of the Large Branches of Trees.

THE following method was communicated many years ago to the Society of Arts, by Mr. Henry Smith, of Bath. The object of the process is to provide against the rot, which frequently attacks the stumps of branches which have been cut off, and sometimes penetrates into the body of the tree, rendering the timber wholly unfit for being cut into planks.

The branch is cut off at a distance of three or four feet from the tree, care being taken to support it in a manner to prevent it from splintering the stump. The bark of the stump is then cut into narrow longitudinal strips, which, after being carefully peeled off with a barking tool, as far as the body of the tree, are tied back so as to keep them clear of the saw in the amputation of the stump, close to the body of the tree. The saw-cut surface is then cut smooth with a wide mortise chisel, and is covered with the strips of bark, cut and fitted to it as accurately as possible, and fastened down with brads, driven in to about the depth of one-eighth of an inch. The wound and surrounding parts are next covered to a depth of two or three inches with a cataplasm, according to the following recipe.

Clay	4 parts
Fresh cow dung . .	2 „
Wood ashes finely sifted	1 „

Add cow's hair, such as that used by plasterers, a handful or more, according to the quantity of the composition required. Mix these materials together in a very regular manner, moistening them with water to bring the whole to a proper consistence.

In order to preserve the cataplasm from external injury, a stout canvas is passed over it, and sewed round the body of the tree.

The bandage and cataplasm must remain on the tree about six or eight months. The removal of the bandage, nails, &c., must depend solely on the healed state of the bark. When the bark is healed, the part of the tree where the amputation of the limb took place will appear as if no limb had grown there.

The operation should not be performed during the winter months when the bark will not separate from the wood, and when the wounded part is liable to be attacked by frost.

W. R.

Planting at Blair Athole.

PLANTATIONS—PRICES—WOODLAND—PASTURAGE.

THE following are the particulars of outlay on one of the largest fir plantations formed by the Duke of Athole :—

LOCH ORDIE PLANTATION, PLANTED WITH LARCH 1815—1818.

PARTICULARS OF OUTLAY.

	£	s.	d.	£	s.	d.
Purchase of ground, 2,932 Scotch acres, 25 years' purchase at 9d. per acre per annum	0	18	9	2,748	15	3
Fencing 11½ miles at 5s. 6d. per rood of 6 yards ...	0	6	2	902	11	3
Roads, drives, and bridges, at 7s. 6d. per rood ...	0	8	0¼	1,177	6	0
Plants, 6,377,100 at 4s. per 1,200 (seedlings) ...	0	7	3	1,062	17	0
Planting	0	3	3	476	9	0
Miscellaneous	0	2	6¾	375	13	6
Making good the failure of plants	0	4	0	586	8	0
	2	10	0	7,330	0	0

A Scotch acre being about five-fourths of a statute acre, the above 2,932 Scotch acres, at 50s. per acre, are equivalent to 3,665 statute acres at 40s. per acre.

The above careful calculation of costs will be useful at the present date as a basis of similar calculations. Mr. M'Gregor, who has charge of the Duke of Athole's woods and forests, has obliged me with details which will bring down the information as to costs to date. Taking the item "plants" first, it will be observed that the first cost was followed by a considerable outlay in making good failures of plants. Seedlings, in fact, are rarely desirable, and if there are rabbits on the estate they are altogether inadmissible. The plants should be two years' seedlings and one year transplanted, or two years' seedlings and two years transplanted, for ground covered unusually thick with herbage. The heather shelters a young plantation, and on an exposed moor it should be as high as the plants.

We may presume from the above that seedlings cost the planter 4s. per 1,200 in his private nurseries. At present plants are dear. Very little seed has been ripened in Scotland during the last two years, and the cost of the common conifers has risen considerably in consequence. The usual price charged by nurserymen is 10s. or 12s. per 1,000 for larch plants, two years' seedlings and two years transplanted, and 8s. or 9s. if one year transplanted. The number required per acre is from 2,500 to 3,000. A man can plant 1,000 or 1,200 plants a day, aided by a woman, girl, or boy. The cost of planting will therefore be about 9s. or 10s. per acre, instead of

2s. 7d., as in the above estimate, and the plants will cost 25s. or 30s. instead of about 5s. 10d.—increased afterwards to about 9s. in the process of "making good." The younger plants will cost from 20s. to 25s. per acre. Since 1847 the prices of labour have risen in the district under notice. Female labour has risen from 10d. a day to 1s. 6d.; men who received from 1s. 6d. to 2s. a day as wood labourers during several years since 1847, now receive from 14s. to 16s. a week. As a rule, they are all able to take part in the varied operations of forest management, such as the erection of fences, whether of stone or wire or wood; planting, cutting, thinning, pruning, draining, &c. The planting of conifers is effected by the operation usually called slitting. This is done with a common spade thrust into the ground, and then again inserted at right angles to the first cut, when the handle of the spade is bent down, so as to open up the cut first made. The assistant, following with the bundle of plants, then places a plant carefully and arranges its roots, and the sod is then let down and trodden well, to fix the plant firmly.

The next detail is that of fencing. The wooden fence, though made upon the spot of home-grown materials, is no longer the cheapest. A common wooden fence 4 feet 6 inches high, is made of four spruce rails of 4 inches by 1½ inch scantling, costing 2d. per yard each. Larch posts sawn once and costing 6d. each, are placed 6 feet apart. The cost therefore is 11d. per yard for the material and sawing 1d., to which 3½d. per yard must be added for the labour of fixing and for nails, total 1s. 2½d. per yard, and the fence will last from 13 to 15 years, when the post will be found to have rotted in the ground, and the fence to have become almost useless.

By inserting intermediate posts, however, one between each of the old posts, at a cost of 6d. per post and 2d. for fixing it, or 4d. per lineal yard of fence, the wooden fence may be carried on to 20 years, at a total cost of 1s. 6½d. per yard. When additional strength is required against some kinds of cattle, struts are fixed at intervals against the posts. Their length is between 7 and 8 feet, and they are nailed to short posts set at the proper distance from the fence according to their length. Before quitting the subject of wooden fences, which are useful for temporary purposes, I must refer to the novelty of a wooden coping on the gates, which preserves them from wet, which is shot off as it falls, instead of soaking into the joints of the gate and lodging between the bars. In constructing this inexpensive and simple coping, the top bar is roofed, so to speak, with two slips of deal running from end to end, and nailed together so as to fit close and form a sharp-angled coping, or by a solid coping cut to a proper angle.

For general purposes the wire fence is rapidly superseding all others, being the least expensive and the most durable. Mr. M'Gregor's wire fences consist of seven steel wires (Nos. 9 or 10), and iron standards set from 12 yards to 18 yards apart. The cost of such a fence is 6d. per yard for the materials, and 2½d. per yard for fixing. The standards are set in stones with melted brimstone mixed with a little fine dry sand. This is not a country for turf dykes, and none exist; but it may be noted here that on suitable soils turf dykes cost 5d. per lineal yard to build 5 feet high from

the coping turf to the bottom of the ditch. In building this fence—on soils with a suitable sod—the turf is placed in front, and the earth from the ditch is used for backing the bank, sloping from the top to the surface of the ground within the fence. A top bar formed of the thinnings of plantations, and fastened to wooden uprights, on a single iron wire, usually completes this kind of fence, at a small additional cost. On some surfaces stones are more plentiful than turf, and they are sometimes used in the construction of a durable fence at from 1s. 3d. to 2s. per lineal yard, including cartage (3d. to 6d., according to distance), and 1s. to 1s. 6d. for building 4½ feet high, including the coping, and 2 feet thick at bottom, diminishing to 16 inches. The wall is strengthened with a scarcement of 3 inches on each side at the base.

In ornamental planting trenching is also resorted to for the purpose of hastening growth, and sometimes for the purpose of burying rubbish which would have encumbered the surface. But the sheltering heather on the Grampians must not be buried, nor is it practicable to dig down into gneiss and mica schist. Moreover, there is strong evidence that a tree—that slow but sure collector of plant food—is as good at fifty or sixty years, without trenching, as with it. In Mr. Selby's work on "Forest Trees" he records some interesting trials of the rapidity of growth of plantations planted respectively on trenched and on untrenched land. It was most rapid during the earlier years of growth on the trenched land, but afterwards the trees planted on the untrenched ground overtook the others, and each plantation finally advanced at the same rate of growth. Scotch planters on the large scale would smile at the idea of trenching their land. They avoid destroying the sheltering heather, and at the same time creating a burden upon estates which in a hundred years would amount to an enormous sum, without the slightest advantage to the timber.

The returns are increased in the case of larchwood by the value of the bark, which is worth from £3 to £4 per ton, for the tannage of sheep skins. Larch is cut on the Athole estates during every month in the year. In the case of the larger-sized timber the bark is too rough to be worth peeling. The peeling of timber for railway sleepers should be delayed till August, as the trees of that size may split from top to butt if peeled earlier. The stripping season commences at the beginning of April, and ends early in September.

The best larch sells usually at from 1s. 2d. to 1s. 4d. per cubic foot. The best Scotch fir is worth 9d. or 10d. per cubic foot, and spruce and silver fir 8d. or 9d. per cubic foot. Larch thinnings measured to 3 inches diameter sell at 6s. per 100 feet, linear measurement. When they run 6 inches diameter for 12 feet (barked) from the ground they are sold at 3d. per lineal foot as far as they hold that girth, the buyer getting the top; and when they run 8 inches diameter up to 12 feet from the ground, they are measured cubically.—H. Evershed, in *Agricultural Gazette.*

Siamese Twin Trees.—An example of this kind of abnormal growth may be seen in Windsor Park, near the Bishopsgate entrance lodge, Englefield Green, very near the water tower in Baron Schrœder's grounds, on the outskirts of the park. Two very large centenarian beech trees, springing apparently from the same root, are united at about 14 feet up.—T. Smith, *Glanty House.*

I was induced this morning to make a sketch of two oak trees, standing about five feet distant from one another, which had apparently started in life independent of each other, but after growing in this unfriendly state for many years, they must have determined to live together; one, therefore, took a "header" into the other, and this being received in a friendly spirit by his neighbour, they have grown up as one tree some 35 feet or 40 feet high, quite healthy and vigorous. The junction is made some 10 or 12 feet from the ground, and makes a picturesque arch seen from a footpath close by. My wood-ranger, who has been on the estate with me for many years, says he has met with several instances of "Siamese twin trees," but they have generally been higher up the trunk of the tree than in this instance.—H. M. Hawley, *Tumby Lawn, Boston, in the "Field."*

The Walnut Tree.—History has no record of the introduction of this tree into Great Britain, but it has been long commonly cultivated in this country, and in some parts it has attained to a goodly size and age. A walnut tree at Gordon Castle, Banffshire, stands 66 feet high, and 11 feet in girth at 3 feet from the ground; and at Altyre, Morayshire, there is one 62 feet high, with a trunk 4 feet in diameter. At Blair Drummond, Perthshire, there is one 75 feet high, and 13 feet 7 inches in girth at 2 feet up; and one of the finest in Scotland is at Eccles, Dumfriesshire, 63 feet high, girth at base 22 feet, and at 12 feet up 13 feet girth. In England there are many fine old walnut trees of which there is no record. There is a fine one at Rufford Abbey, Notts., the butt of which, although only 4 feet long, girths 21 feet 10 inches at 2 feet up. Another particularly remarkable tree, which grows at Downland, Hants, measures 16 feet in girth, and contains 223 cubic feet of timber. The above are but pigmies in comparison with the prodigious size and great age which the walnut tree attains in Eastern Europe. In the Baidar Valley, near Balaclava, in the Crimea, grows a walnut tree at least 1,000 years old, which yields annually from 80,000 to 100,000 nuts, and belongs to five Tartar families, who share its produce equally. Scamozzi, an Italian architect, mentions having seen at St. Nicholas, in Lorraine, a single plank of the wood of the walnut, 25 feet wide, upon which the Emperor Frederick III. had given a sumptuous banquet.

Old Bird-cherry Tree in South Yorkshire.—The following are the dimensions of an old bird-cherry tree (*Prunus padus*) growing in Eccleshall church-

yard:—Close to the ground its circumference is 3 feet, at 1 foot up 2 feet 6 inches, at 4 feet up 2 feet 5 inches, where it parts into two principal limbs, the diameter of head of the tree being 28 feet, and the height of the whole tree 26 feet. I cannot form any idea of its age, but an old person who has known it for thirty-five years says that it seems to have altered but little in that time. There was once another tree of a similar size, but it was blown down during a gale a few years ago.—T. L. Bailey, *Holt House, Abbeydale, Sheffield in the "Garden."*

Timber Notes from California.—The *Pinus Lambertiana*, or sugar pine, is the best pine we have for finishing purposes, and frequently attains a diameter of from 8 to 10 feet, and an altitude of 250 feet. It is often 120 feet to the first limb, and "straight as an arrow." The *Pinus ponderosa* is more durable exposed, and has a much greater strength for heavy timbers, floors, joists, &c. The wood of Redwood (*Sequoia sempervirens*) is in every respect like the wood of the big tree (*Sequoia gigantea*), and is second only in size to the latter. Both are invaluable for lumber, and exceedingly durable. As an instance of the latter quality, I will mention one example I found in the Frenzo Grove. A tree about 26 feet in diameter lay prostrate; another of the same species had grown up beside it, but as it was unable to push the prostrate monarch out of its way, *it had grown over it six feet and eight inches;* and although it had probably been there hundreds of years, was quite sound when I saw its thrifty young scion growing over it. The timber in the "mission" buildings of California is mostly redwood; yet, although nearly one hundred years have rolled away since they were built, the timber is perfectly sound. Then, in specific gravity, it is lightest of all. Its value, however, would be mainly for finishing purposes, as the yellow pine would bear a tension of three to one where strength was needed. It splits easily either way of the grain. Owing to this latter, and other qualities, it has become almost indispensable for fence-posts and railroad ties, &c. The sugar pine is easily riven, and it forms the staple timber for "stakes" and "shingles." These trees do not command the attention their invaluable qualities would invite and justify.—*Gardener's Monthly.*

Forests of Sweden.—The principal part of the timber of the Swedish forests, according to the *Chronique de la Société d'Acclimatation*, is furnished by the Scotch pine and Norway spruce fir. The white birch is also widely diffused and abundant in that kingdom. The aspen and the alder, the elm and the lime, are also common, and attain large dimensions in some districts. The timber of the spruce and silver fir is used in the construction of houses, ships, &c.; moreover they furnish tar, and the wood reduced to a pulp is employed in the manufacture of paper. Balks and planks of these two kinds of timber are largely exported. Birchwood is chiefly consumed as fuel, supplying nearly all the coasting vessels in the Baltic. As an example of the extent of trade in this article, we may mention that no less than 25,483,678 cubic feet of birch-wood for fuel were shipped from a single port in 1872. The wood of the aspen is used in the manufacture of matches, one of the most flourishing industries of Sweden.

A Tree-planting Law in California.—By a law of California, approved March 30th, 1868, the Board of Supervisors in each county are empowered to authorize owners of lands to plant and cultivate, along the public highways, shade and fruit trees, specifying the species to be planted, at what age, at

what distance from each other and from the road-bed, and making the necessary rules for their protection, &c. Four years after the planting, upon receiving a duly certified statement of the number then in a thrifty condition, the Board is directed to pay to the cultivator £1 for each such tree. In October, 1872, the State Board of Agriculture called attention of County Supervisors to this Act, and urged them to do what is in their power to encourage a compliance with its provisions. They advised that the age be fixed from three to eight years from the seed, and the minimum distance between tree and tree at twelve feet, and recommended the planting of the following varieties: black and honey locusts; black, white, and fruiting mulberries; Osage orange, native and eastern black walnut; American chestnut; American, European, and cork-bark elm; the different varieties of maple; tulip-tree; Carolina, Lombardy, and silver-leaf poplars; the different varieties of ash; apple, pear, plum, cherry, almond, and fig trees; the Eucalyptus or Australian blue and red gum tree; Monterey, sugar, yellow, spruce, and Scotch pines; Norway spruce, balsam fir, European larch, Monterey and Italian cypress, and California laurel; and redwood.

The Yellow Pines.—The investigations of Professor Sargent show that in all the large lumber centres—Wilmington, Baltimore, Philadelphia, New York and Boston—"yellow pine" is exclusively applied to the timber of *Pinus australis* (*Pinus palustris* of Lambert). Much of the confusion in "yellow," perhaps, arises from the fact that the prevailing "yellow pine" of old lumbermen was *P. mitis*, which is now rarely (if ever) in market.

The Timber Line in the various Mountains.—In the Himalayas, trees grow up to a height of 11,800 feet, and there are often forests just below this line. In the Andes the growth of trees ends at 12,130 feet; in the Alps it ends on an average at 6,400 feet, but it is stated that specimens of trees are found above 7,000 feet, but the pasture-grounds in Thibet are known to extend over an elevation of from 15,000 to 16,350 feet.

Italian Forests.—In a recent report from Venice the forests of Belluna, Udine, and Trento are described as being very extensive, and to possess almost inexhaustible quantities of timber, though more facile means of transport are required to bring it into the market. The produce of the pine forests of the mountains of Venetia is sent down in planks, on rafts, along the Piave and other rivers to the port of Venice. The trade in planks is conducted on a very large scale for the supply of railway companies as well as for exportation to the last. Venice is a very important depôt for timber on account of its proximity to the rivers Po and Adige, and it is said that a larger stock is probably kept at Venice than at any other port of the Adriatic or Mediterranean.

A Noble Oak.—Mr. Wilson, of Shrewsbury, lately purchased from Colonel Edwards, Great Ness, a fine oak, supposed to be the largest sound tree in Shropshire. At five feet from the ground it measured twenty feet in girth, and with its immense tops it contained upwards of 600 cubic feet of timber, and produced about three tons of bark. The total estimated weight is at least thirty tons.

Ministries of Agriculture.—We find an article in some of our exchanges, without specified origin, giving the titles of public officers under various governments, having charge of their agricultural interests, alone or in con-

nection with other interests, from which we condense the following statement:—Austria, minister of agriculture; Hungary, agriculture, industry, and commerce; France, commerce and agriculture; Prussia, agriculture; Italy, commerce and agriculture; Roumania, public works, trade, and agriculture; Brazil, public works, agriculture, and commerce; dominion of Canada, agriculture; Belgium, agriculture and manufactures; Japan, agriculture and industry; Spain, agricultural bureau; Victoria, lands and agriculture; United States, agricultural department.

The Foresters' Grindstone.—There is no tool so essential to the forester as a good grindstone; it is therefore necessary that every forester should have one and know how to take proper care of it. A grindstone should always be kept under cover, as exposure to the sun's rays hardens the grit and injures the frame. The stone shoud not be allowed to stand in water, as this causes soft places. The water should be allowed to drip from some vessel placed above the stone, and the drip should be stopped when the stone is not in use. All greasy or rusty tools should be cleaned before being sharpened, as grease or rust chokes up the grit. The stones should be kept perfectly round and level on the face.

Hafting an Axe.—Get your blacksmith to make an iron wedge to fasten the handle in with. It will cost but a few pence. It should be about two and a half inches long, and about two in width, and the head of the wedge should be large enough to cover the eye of the axe. It is much better than the wooden one generally used for such purposes, as it can be easily knocked out with a cold chisel and hammer. The usual method of burning out a helve after it has been broken softens the steel of the axe. Another advantage is that sometimes an axe is broken, while the handle remains good, then the iron wedge can be knocked out, and it is ready to be put in another axe.—*Western Rural.*

Ballochbuie Forest.—The following, with reference to the rumoured purchase of a Scotch forest by the Queen, says a contributor to *Mayfair*, reaches me from a source which guarantees its authenticity:—"The Queen has not bought the forest. She has not wished to buy it. But it has been offered her for something like a hundred thousand pounds, and she may buy it to keep it out of other hands. The forest is, however, entailed, and Colonel Farquharson, the owner, must obtain a private Act to enable him to sell. This is likely to be opposed by maternal relatives of his heir; but he hopes that the influence of her Majesty and the Prince of Wales will remove danger of defeat. The Queen is, meanwhile, lessee of the forest. She pays an annual rent of £1,500—not £15,000, as stated in the *Times* and other London papers. She became lessee to prevent Farquharson from cutting down the wood, which is the finest of its kind in Scotland. Eleven years of her lease have yet to run, so that there is no particular reason why she should buy just at present. The name of the forest is not Ballochbine, as you say, or Ballockfine, as the *Times* said, but Ballochcowie—which is fearfully Scotch. The forest includes the Mountain of Lochnagar, which has been made classic ground by Byron. [This paragraph has lately been going the round of the public papers, and appeared in our June number. We only insert it to again emphatically contradict it, as we have since learned on the best authority that no such transaction has ever been entered into. The erroneous spelling of the name points the origin of the report. Ballochbuie, the proper name, is excellent Scotch.—[Ed. J. F.]

Easy Method of finding the Nature of Soils.—A good method for the planter who is interested in knowing what sort of soil he is planting in, is to mix an ounce of soil with a pint of water till it is perfectly softened and diffused, to shake it well and allow the heavy parts to settle for a few minutes; the sand will subside and the clay will remain floating, in finer particles. Pour the water out with these finer particles, leaving each in separate vessels; get it dried and then weigh separately. If 100 grains of soil, not peaty or unusually rich in vegetable matter, leave

10 grains of clay,	it is	sandy soil.
10 to 40 . . .	„	sandy loam.
40 to 70 . . .	„	loamy soil.
70 to 85 . . .	„	clay loam.
85 to 95 . . .	„	strong clay soil.

If there is no sand it is pure clay. It often occurs that people who are said to know a great deal about soils will term them, by a single look, as sandy loam; try and see if it is not anything but sandy loam! An important matter is to discover whether lime in quantity is present in the soil. This can be easily done by heating the sample of soil in the air until the organic matter is burned away. Take 200 to 300 grains, which diffuse well through half a pint of cold water, mixed with half a wine-glass of muriatic acid, and allow it to stand a few hours with an occasional stirring, when the bubbles of gas will cease to rise, the water can be poured off, the soil well dried as before, heated to redness, and weighed. The loss will be nearly all lime.

The Phormium Tenax, or New Zealand Flax, is, it is said, being largely planted in St. Helena on behalf of a fibre company, who propose so to plant all the Government waste lands in the island. The leaves contain a large amount of strong fibre, hitherto rather difficult to manufacture; but recent experiments are likely to render it very useful in paper-making.

The Value of Timber in the Highlands.—An illustration of the value of timber on waste lands in the Highlands is afforded by a sale of wood which took place recently on the estate of the Earl of Cawdor, in Nairnshire. In 1820, two hills on the Cawdor property, of about 800 acres in extent, and of almost no agricultural value, were planted with fir and other trees, and after successive thinnings, the sale of which realized large sums, the remainder of the wood has just been sold off for the sum of £16,000. The sums realized for the wood on this waste land during the fifty years is stated to be equal per acre to the return for the best arable land in the country.

The Nettle Tree (*Celtis australis*), although of moderate dimensions, furnishes a timber of great commercial value, and the slender, flexible branches are in great request in many parts of Europe for whip stocks. In the neighbourhood of Udine, according to the German papers, large plantations are now cultivated, actually tilled, and manured. The trees are planted about six feet apart, the lower branches being trained off, and in ten years the trunks attain a diameter of six to eight inches. The wood from these plantations is fine-grained, is easily cleft, and, being of a beautiful yellow colour, fetches a higher price than the ordinary quality. In Istria this tree is commonly planted in the squares and near churches. In Moschenizza there is a tree with a trunk five feet in diameter at the base; and in Germino there is one six feet in diameter, supposed to be a thousand years old.—*Gardener's Chronicle.*

Growing Wood for Fuel.—A Canadian farmer, about twelve years ago, planted six American cottonwood trees (*Populus monifilera*, black Italian poplar) and one silver abele poplar, on seven square rods. Lately cutting them down and preparing them for fuel, he realized four cords of nice wood. An acre at the same rate would have yielded eighty cords.

Liverpool Timber Market.—The quantity of timber and deals which continues to be taken into consumption is somewhat surprising, when not only the general state of trade is taken into consideration, but that in nearly all the districts which receive their supplies from this port, strikes among the workmen are prevalent, and that the building trades are therefore more or less crippled in their operations. The marked features in the trade is the avidity with which sawn pitch pine timber has been taken by customers, the quantity delivered being almost double that of last year, while hewn pitch pine logs also are in more demand than was the case during this time last year. Prices of both have probably now touched their lowest, and sales at prices current a week or two ago cannot now be effected. Stocks of Quebec pine continue large, though a slightly better demand is existing. In birch, elm, and other hardwoods there is very little doing, and oak of prime quality only is saleable. Spruce deals have been largely sold, merchants being now desirous to clear off old stocks, so as to make room for the import of the coming season under the pressure that exists for more accommodation, which the extent of the trade now demands.

Land Reclamation in Morecambe Bay.—A project is on foot, and, indeed, in process of execution, for the reclamation of a large portion of Morecambe Bay from the sea The Warton Land Company are on the point of reclaiming about 10,000 acres of land, stretching from Hest Bank Station on the south and Arnside Point on the north. A fine sea wall is to be built, and it is proposed to carry the river Keer through sluices. It is thought that this scheme will afford a shorter route to Barrow by highway and railway, and will form a more efficient connecting link between the two parts of Lancashire on the north and South of Morecambe Bay. The cost of the works is estimated at £150,000, and the estimated value of the land to be reclaimed is £400,000.

Prices of Timber in Lancashire.—The following prices have been obtained at recent sales, both public and private, of home-grown timber in the district of south-east Lancashire :—Oak, 1s. to 3s.; ash, 1s. to 1s. 9d.; elm, 10d. to 1s. 3d.; beech, 10d. to 1s.; poplar, 10d. to 1s.; horse-chestnut, 8d. to 1s.; birch, 8d. to 1s.; lime, 10d. to 1s.; alder, 10d. to 1s.; willow, 10d. to 1s.; larch, 1s. to 1s. 6d.; and Scots fir, 10d. to 1s. 2d., all per cubic foot.—D. D. H.

John W. Evarhart, of Marion county, Virginia, chopped down a chestnut tree the other day that contained 31 gallons of nice honey a distance of 10 feet from the butt. He afterwards made 600 rails and 1,000 shingles out of the tree

Wild Cherry Timber.—A Massachusetts correspondent of the *Ploughman*, referring to *Cerasus serotina* says :—"You cannot have for many purposes a better tree than the wild cherry, and it is a rapid grower. It is found in all our forests. And what is better or handsomer for the interior work of houses and for cabinet work than the wood of the butternut tree and this, a rapid grower on rocky soil as well as good, in any part of our State."

Sweet Gum as Tan Bark.—One of the most useless trees of the Southern States, and yet the most abundant, is the beautiful Sweet Gum, *Liquidambar styraciflua.* In the last number of the "Monthly Reports of the Department of Agriculture," Mr. McMurtrie, the chemist of the department, says that the bark contains 8·36 per cent. of tannic acid, which is more than any of the oaks give, as per the same table, which we give below. The "Quercitron," we suppose, is *Quercus tinctoria*, and not *nigra*, as therein stated.

	Per cent.
Ground sumac (mixed), Winchester, Va.	24·18
Sumac (*Rhus cotinus*), Hallsborough, Va.	24·08
Sumac (*Rhus glabra*), Georgetown, D.C.	26·1
Leaves of sweet fern (*Comptonia asplenifolia*), near Boston, Mass.	9·42
Leaves of *Polygonum amphibium*, Nebraska	11·6
Ephedra antisyphilitica, table-lands of Arizona and Utah ...	11·9
Bark of sweet gum (*Liquidambar styraciflua*), District of Columbia	8·36
Bark of red oak (*Quercus rubra*), Canton, Ill.	5·55
Bark of white oak (*Quercus alba*), Canton, Ill.	7·85
Crushed quercitron bark (*Quercus nigra*), Winchester, Va. ...	6·47
Bark of *Quercus coccinea*, Canton, Ill.	7·78
Bark of *Quercus macrocarpa*, Canton, Ill.	7·85
Bark of hemlock (*Abies Canadensis*), Van Ettenville, N. Y. ...	9·5

The Chilian Pine.—The beautiful conifer (*Araucaria imbricata*) is looked upon as a fruit-tree in its native country, Chili and Araucaria. The Indians and other inhabitants of those countries eat its seeds raw, roasted, and boiled; they are said to be very nutritious; about 200 form a good meal for an adult. One seed-cone contains from 200 to 300 seeds, and every tree bears many such cones, which, when they have arrived at maturity, drop to the ground. The seeds lie in such great numbers on the ground, that only a part of them are collected. The Indians have also a way of making a kind of brandy from these seeds.

Waste of Timber.—Within ten years, no less than 12,000,000 acres of forest have been cut down or burned over in the United States. Much of the timber is used for fuel, 25 cities being on record as consuming from 5,000 acres to 10,000 acres each. Fences use up much timber, and railroad ties require the product of 150,000 acres per annum. The amount of pine and lumber timber yet standing in the forests of the timber States is estimated at 225,000,000 feet. The sum of 144,000,000 dollars is invested in the timber industry, employing 2,000,000 men.

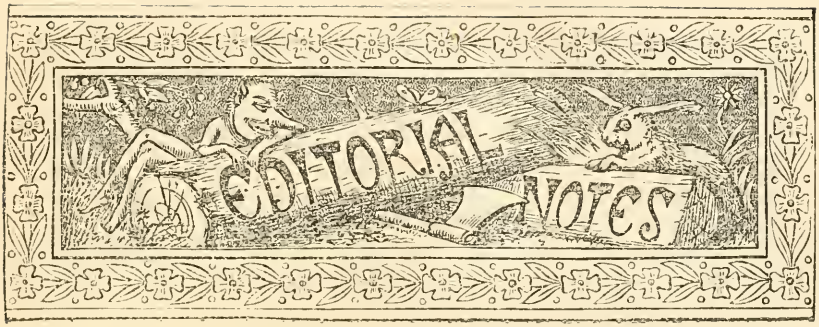
A Large White Oak.—A newspaper paragraph tells us that "a white oak tree, recently felled in Michigan, measured twenty feet in circumference, and revealed 380 rings in the grain; so it must have started about the time America was discovered."

Landlord and Tenant in Scotland.—A curious case of a farmer who was sent to prison for failing to cultivate his land has lately come before the law courts in Scotland. A farmer in Inverness-shire having failed to plough and otherwise cultivate three-fifths of his farm, which by his lease it was affirmed he was bound to do, and having been called upon to fulfil his obligation, and failing to do so, he was apprehended and imprisoned. In the lease, which the landlord had registered in the books of council and session, there was a specific obligation upon the farmer "to cultivate and manage the land according to im-

proved rules of good husbandry." To the landlord's order the tenant paid no attention, either by communicating with the landlord or his agent, or by taking any steps to plough and cultivate, and a warrant of apprehension was taken against him in terms of his registered lease, and he was sent to gaol on the 25th of March. The tenant hereafter presented a suspicion and liberation, and Lord Ormidale has passed a note to try the question, but in the meantime has granted liberation. A reclaiming note is about to be presented to the First Division by the landlord. It is affirmed that the tenant, about the 18th of January, under the cloud of night, removed the whole stock and implements of husbandry, and about the same time dismissed the ploughman. When the officer went to sequestrate the farm on behalf of the landlord he only found an old disabled mare, two small pigs, and two "pet sheep" belonging to the tenant, while belonging to a neighbouring farmer there were about forty head of cattle and 200 sheep on the farm eating the turnips and straw. The explanation given was that the turnips and straw had been sold and bills granted.

Irish Farming in 1876.—The directors of the Provincial Bank of Ireland, in their annual report, remark as follows upon the results of last harvest in Ireland:—"In consequence of the unusually dry weather which prevailed during the summer, the season of 1876 was not favourable to agriculture. Most grain crops were deficient, and straw, which has of late become so valuable, was very short. Turnips, at one period, threatened to be a failure, but the rain, which fortunately fell in the autumn, had a beneficial effect, and a fair crop was the result. Potatoes were very abundant and free from disease, but they did not keep so well in pits as in former years. Hay, though sowed in excellent condition, was not more than half an average crop, and graziers had, in consequence, to sell a portion of their stock towards the end of the year at low prices, which under ordinary circumstances they would have had sufficient fodder to maintain during the winter. Foot-and-mouth disease, which was prevalent in the cattle districts last year, has disappeared, and the prospects of graziers are now fairly satisfactory. The corn trade in Cork appears to be recovering from the result of the large failure which had occurred in the early part of last summer, and this business would now seem to be in a more healthy condition."

Tree Murder.—The plane trees in the garden of the churchyard of St. Botolph, Bishopsgate, are now (says the *Gardener's Magazine*) in a nice condition to illustrate the first principle of tree murder. Those planted on either side of the public pathway to form a shady avenue have been carefully "pruned back," and are worthy of a momentary inspection by such as are interested in town trees, and know something of the way they should be managed. It will be observed that they have made a nice growth, and if left unpruned would now meet overhead and make a delightful shade, which pedestrians would appreciate. But as they have been severely cut in, their natural beauty is marred, and their vigour of root-action diminished. There are no windows robbed of light by these trees, and there is no reason apparent why they should be pruned at all.



THE excessively heavy rainfall of the present season, although very injurious to many kinds of crops, has proved beneficial to most sorts of hardy evergreens, especially Coniferæ that are growing in suitable soil sufficiently drained, artificially or naturally, to carry off the surplus water. In several parts of the country visited lately we have observed that evergreens are making an unusually vigorous growth after having flowered more profusely, as previously remarked at page 149, than they have done for some years past.

It will require a dry warm autumn to ripen such a luxuriant, growth, to enable it to withstand the severities of winter. So far there is no present appearance of the weather clearing up, and it will be interesting to observe how the different trees and shrubs withstand the rigours of winter, should the weather unfortunately not prove favourable in time to thoroughly ripen this season's growth. Such fine growth, if well ripened, ought naturally to produce another plentiful crop of flowers, &c.—a circumstance which very rarely occurs in two succeeding years.

Old plants of the common and Portugal laurels produced a perfect sheet of blossom in many parts of the country during June and July; but it has not prevented them making a very free growth since then, as well as the holly, boxwood, rhododendron, and "American" plants generally. The holly has set a full crop of berries, which will prove highly welcome at Christmas-time to our English homes, should no unforeseen mishap occur to interfere with their arriving at full maturity.

Amongst Coniferæ, the *Wellingtonia* has made a very full growth, more particularly upon the lateral branches, which are beautifully

furnished with a profusion of light green spray, while the top leader has also added more than the annual average to height and robustness.

Cupressus Lawsonii, and all its varieties, are also making a particularly luxuriant growth where they are planted in suitable soils; and nearly all the varieties are most elegant and graceful plants for ornamental plantations and pleasure-grounds, when they are seen in such perfect character as they display this season.

Thujopsis borealis, which is perhaps the most beautiful of all the cypress tribe, and at the same time one of the hardiest of conifers, has never been seen in better perfection than at present; indeed, this remark applies to most of the coniferous family introduced from North-West America—pines, furs, sequoias, cypresses, thujas, &c., the dripping season agreeing remarkably well with their natural constitution and habits, and proving that they are the kinds of trees that ought to be principally planted in the moist and mild climate of our western coasts, and in all inland parts where the annual rainfall exceeds the average of the country, such as the Lake districts of Westmoreland and Cumberland, many parts of Wales, the western Highlands of Scotland, and probably two-thirds of the whole of Ireland. Not but that the same Coniferæ will thrive well and profitably in most of the eastern and drier parts of the country, but they are seldom to be seen in these parts in such robust health and luxuriance as in the moister and more equitable climate of the western districts.

The *Araucaria imbricata* and other hardy Coniferæ from South America also appear to enjoy the extra moisture; but it may eventually prove very detrimental to them if the ensuing winter is a rigorous one, when from their gross sappy state, severe frost would be certain to do them serious injury. The *Deodar* and other Himalayan Coniferæ have made a moderately strong growth, and the same may be said of the Coniferæ from Japan, many of these latter having proved to be peculiarly well adapted to the climate of Britain, and although few of them are likely to become useful timber trees, they are quite indispensable in "collections" and for all ornamental purposes.

The *Golden Yew, Golden Thuja, Variegated Cypresses, Retinosporas, Junipers*, &c., have been remarkably brilliant and lasting in their beautiful shades of varied colours, contrasting well with the deeper shades of green displayed by their more generally vigorous neighbours.

Now that the period of growth is about over, we will be glad to hear from our correspondents how the newer Coniferæ have thriven in their districts during this uncommonly wet and changeable season; and also what appearance there is of a crop of Coniferæ and other forest tree seeds, including holly and hawthorn.

In addition to what we stated last month, at page 228, relative to the liberal and praiseworthy efforts which the State of Massachusetts is making for the encouragement of arboriculture, we are much pleased to place before our readers, through the kindness of our able and esteemed American correspondent, Mr. Burnet Landreth, of Philadelphia, who has favoured us with a copy, the following extremely liberal Schedule of Prizes, which have just been offered for the further encouragement of the cultivation of first-class timber trees in that notedly enterprising State. Such valuable prizes will undoubtedly produce a numerous array of eager competitors, and they should also prove to be an effectual method of giving a strong and lasting impetus to the raising and cultivation of useful and profitable timber, which will at the same time afford a much-needed and most effective shelter to the land cultivated for other crops. Under the management of specially appointed trustees, the following prizes are open to all landowners in Massachusetts, and will be awarded in 1888, the trustees reserving the right to withhold one or all of them if, in the opinion of the judges, none of the competing plantations are considered worthy of award:—

For the best 5,000 White Ash trees . . .	$250.00
„ „ next best 5,000 White Ash trees . .	100.00
For the best 1,000 White Ash trees . . .	100.00
„ „ next best 1,000 White Ash trees . .	75.00

Trees intended to contend for these prizes may be either planted in groves or scattered, as the nature of the soil and other circumstances may require; provided, however, that the plantation does not extend beyond the estate of the competitor.

For the best 5 Acres of White Pine, raised from seed planted by the competitor . .	$250.00
„ „ next best 5 Acres of White Pine, raised from seed planted by the competitor .	100.00
For the best Acre of White Pine	100.00
„ „ next best Acre of White Pine . .	75.00
For the best Acre of Scotch Pine (*P. sylvestris*), raised from seed planted by the competitor	100.00
For the next best Acre of Scotch Pine (*P. sylvestris*), raised from seed planted by the competitor	75.00
For the best Acre of European Larch, containing not less than 2,000 trees . . .	100.00
„ „ next best Acre of European Larch, containing not less than 2,000 trees .	75.00

All entries for these prizes must be made on or before March 1, 1878, to Mr. Francis Skinner, Brookline, Mass.

Mr. Skinner has consented to act as the agent of the trustees in all matters relating to these prizes, and will furnish all information in regard to them.

Competitors may order their seeds and trees through Mr. Skinner, who will arrange with the principal tree and seed dealers and nurserymen in the United States and Europe for the lowest possible rates.

All competitors will be expected to keep as accurate accounts as possible of the cost of forming and maintaining their plantations, and to furnish the trustees, from time to time, with such information in regard to them as they may require.

The above prizes are offered by the "Massachusetts Society for Promoting Agriculture," and we would strongly recommend the excellent example set by it to the favourable notice and consideration of the Royal Agricultural Societies of England and Ireland, in default of a properly constituted Arboricultural Society or Government authority in either country, the special duty of which we hold ought to be the promotion and encouragement of the judicious and profitable planting of trees, and the efficient teaching of arboriculture in all its various branches.

The Scottish Arboriculture Society is, we believe, doing much valuable and praiseworthy work with comparatively small means, in furthering the interests and spreading a correct knowledge of arboriculture throughout the United Kingdom; and when the means at its command will permit, no doubt it will offer prizes for this and similar objects in connection with the extension and improvement of our plantations, in addition to those it already offers for essays on practical forestry and kindred subjects. In the meantime we think the Highland and Agricultural Society might, with much advantage, take a leaf out of the book of the Massachusetts society, and devote a share of the large surplus funds, which it is happily in possession of, to the promotion and encouragement of the extensive planting of the bare wastes, muirlands, and mountain-slopes, which still occupy such a large extent of the country, and can never be profitably cultivated as arable land, or put to any other use half so remunerative to the proprietors or beneficial to the country.

Now that the city of Edinburgh has acted so liberally in purchasing the house and grounds of Inverleith, and has handed them over free to the Government for the purpose of forming an arboretum, &c., in connection with the adjacent Royal Botanic Gardens, we trust that the question of the foundation of a School of Forestry in connection therewith will receive the earnest attention it deserves at the hands

of the Government and the authorities of the University of Edinburgh. The vital importance of the subject to the welfare of the country and our colonies urgently demands that the establishment of a British School of Forestry be no longer delayed; and, under all the circumstances, the present is a fitting opportunity for starting such an institution on a suitable and satisfactory basis. The extent of the ground at Inverleith precludes any idea of teaching practical forestry within its bounds; but for the teaching of scientific forestry it is peculiarly well adapted, and from its central position and close proximity to such a famed seat of learning as Edinburgh, it possesses more real advantages and available resources than any other similar site in the country. An institution for the technical and scientific education of foresters can be established there at a comparatively trifling cost, and conducted with the highest efficiency at a less annual expenditure than would be possible in any other university city in the United Kingdom. Undoubtedly learning, like everything else now-a-days, cannot be had for nothing, and education in its best form deserves the highest remuneration, and must be properly paid for if we are to derive the greatest benefits from it; but owing to the great educational facilities afforded by Edinburgh, which have been already so forcibly pointed out in our pages by Dr. Croumbie Brown, and the acknowledged eminence and talent of its professional staff, we consider that for thorough efficiency, high quality of education, and comparative economy, Edinburgh stands prominently ahead of all other likely places for the establishment of such an institution.

A properly equipped School of Forestry, with its head-quarters or nucleus at Inverleith, under the direct management of the Government, or the Edinburgh University authorities, would afford all the means required or necessary for our foresters acquiring a thorough technical and scientific knowledge of their profession, and enable them to successfully compete with the students of the Continental Forest Schools for Indian and other forestal appointments.

For the present, the *practical* part of forestry is well taught, and systematically practised, by able and intelligent foresters in most parts of the United Kingdom, under some of whom the students of the Forest School could learn, in the best possible manner, all the points of practical forestry which cannot be efficiently taught on a limited area of ground like Inverleith, which ought to be wholly devoted to the growth of specimen trees, shrubs, &c., for educational purposes or for landscape effect. There is, thus, no pressing necessity for a great expenditure of money in purchasing or leasing a large extent of land or forest for the practical teaching of forestry, in imitation of the Forest Schools on the Continent. Instruction in practical forestry may be safely left for the time in the hands of

those who are now so ably and efficiently imparting it; but to aid them in their praiseworthy efforts, and complete the work they have so well begun, the institution of a National Forest School is a necessity that cannot much longer be delayed, and which we trust to see carried into effect by the proper authorities within a reasonably short time.

THE genus *Fraxinus*, or Ash, is composed of deciduous trees which are natives of Europe, a considerable part of Asia, Northern Africa, and North America. They are raised from seeds collected in the autumn and sown in the following spring, and the varieties are propagated by grafting on the common ash, *Fraxinus excelsior*. The Ash has a great tendency to run into numerous varieties, which so closely resemble each other that much confusion has ensued, and for all practical purposes very few of them are worth notice.

The Common Ash is the only species which is found profitable for cultivating in this country; but the most important representative of the genus in America is the White Ash (*F. Americana*), for which, as stated in another paragraph, handsome premiums are now being offered to promote and extend its cultivation in the United States. For general usefulness in the arts and constructive economy it is surpassed by no tree, except, perhaps, the oak. From the rapidity of its growth, the graceful beauty of its foliage, and the valuable qualities of its timber, it is one of the most popular and interesting of American trees. In favourable situations it attains a height of eighty feet or more, with a trunk three feet in diameter, and often presenting a clean straight bole for more than half its length. It grows best in a deep, rich soil, near the edges of streams or swamps, but free from stagnant water, its roots delighting in a deep, fertile, moist soil, intermingled with stones, and having a porous subsoil. It is a native of North America, from Labrador to the Carolinas, and is particularly abundant where the climate is moderately cool and moist. It is a robust, healthy, and quick-growing tree in such localities, and is little liable to damage from storms, or to be attacked by insects. The wood of the white ash, in young thrifty trees, is very white throughout, but in large old trees the heartwood assumes a reddish tinge, the sapwood only being very white. In free-grown trees, in which the annual layers of wood are large or thick, the timber is found to be exceedingly tough and elastic, and may be applied to a great variety of useful purposes. It is employed by coach, waggon, and cart makers for the felloes of wheels, for shafts, and for the frames of carriages; &c. It is used almost universally in the eastern States, and in others where it can be had, for the

manufacture of agricultural implements and domestic wares, especially for the handles of spades, hoes, scythes, rakes, and other light implements. In Canada and the northern part of the United States it is extensively used for hoops and staves, the latter being esteemed for casks to contain salted provisions and flour. For the blocks of pulleys, handspikes, belaying pins, and such purposes on board ship, it furnishes the best of material, and it is in universal use for oars in all maritime parts of the world. The wood is extensively imported into Europe in the form of planks; the inner bark of the tree imparts a very permanent yellow dye to skins, and is much used in Canada and the States for dyeing wool. The wood, when thoroughly well seasoned, is not liable to shrink, warp, or swell; hence it is a most valuable timber for flooring, and makes the most beautiful of floors from its whiteness and clear grain.

THROUGH the kind interest which Sir Robert Christison, Bart., takes in all things arboricultural, the public have now an opportunity of seeing in the National Industrial Museum of Science and Art, at Edinburgh, a curious relic of the ancient forest of Glenmore, and of judging of the quality and valuable properties of the native Scots fir timber. At the request of Sir Robert, the Duke of Richmond and Gordon has sent for exhibition in the Museum a plank of Scots fir, 5 feet 7 inches wide at the bottom, which was presented in 1806 to the then duke, by the person who purchased and cut down the whole of Glenmore Forest. It bears its rather curious history on a brass plate affixed to its face, of which the following is a verbatim and literal copy:—

"In the year 1783 William Osbourne, Esq., merchant, of Hull, purchased of the Duke of Gordon the Forest of Glenmore, the whole of which he cut down in the space of 22 years, and built during that time at the mouth of the River Spey, where never Vessel was built before, 47 Sail of Ships of upwards of 19,000 Tons burthen. The largest of them, of 1,050 Tons, and three others but little inferior in size, are now in the service of his Majesty and the Honble East India Company. This Undertaking was compleated at the expence (for Labour only) of above 70,000£.

"To his Grace the Duke of Gordon this Plank is offer'd as a Specimen of the Growth of one of the Trees in the above Forest by his Grace's

"most obed^{t} Servt

"W. OSBOURNE.

"*Hull, Sepr 26th*, 1806."

Sir Robert Christison has, with his usual accurate criticism,

examined this plank, and reports to us as follows, regarding the tree from which it had been taken:—

"The tree must have been 19 feet in girth at the bottom of the plank, and 16 at top, 6 feet 3 inches higher up. I can make out 243 layers on one radius; seven are wanting in the centre, and seven years at least must be added for the growth of the tree to the place of measurement. Hence the tree must have been about 260 years old. The outer layers on this radius are so wide that it must have been growing at a goodly rate when it was cut down."

The plank is in the front corridor, immediately on the left hand as one enters the main hall of the Museum, leaning against the wall which partitions off the corridor from the body of the hall. We call attention to this highly interesting historical arboricultural relic in order that many of our northern subscribers, when in Edinburgh, may visit the Industrial Museum there, and inspect it for themselves, feeling sure that after seeing so noble a specimen plank of indigenous Scots fir timber, they will share with us in the regret that not one specimen tree of this forest was spared by its ruthless destroyer, either to transmit to future ages the seeds of so noble and lofty a line, or to mark the spot where once stood so many monarchs of the forest.

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During the last few days of the late session of Parliament the Government passed through both Houses a bill called the "Destructive Insects Act, 1877;" the title of which is a complete misnomer, as the Act is solely directed against the Colorado beetle, and makes no provision whatever for preventing or diminishing the attacks of the hosts of other destructive insects which are the cause of so much havoc every season in our forests, fields, and gardens. This Colorado fellow is no doubt a troublesome customer in the potato patches of the United States, where climate and other circumstances are suitable to the healthy existence of such nefarious vermin; but it has still to be proved that the voracious creature will thrive and multiply exceedingly in the broad potato-fields of Yorkshire or the Lothians, or on the "lazy beds" of the Irish peasants' national esculent. The cold, raw, changeable climate of the British Isles is more than likely to prove a match for this unwelcome Western visitor, and will probably prevent him from committing any extensive damage to our potato crops; but it is best to be provided for all contingencies in cases of this kind, and this Act gives full powers to the Privy Council to take efficient means for stamping out the Colorado Beetle, should it unfortunately gain a foothold upon our shores. Such an Act of Parliament is quite right and proper, and, if strictly applied,

will, we believe, prove effectual; but we fail to see why the Act should stop at the *expected* invasion of the Colorado Beetle, when our crops are already being devoured by insect pests which are quite as injurious in their own way, probably even to a greater extent than ever the Colorado pest will be in this country, and for which we have no legal power to enforce their destruction if our neighbour chooses to harbour them, either through ignorance, neglect, or some perverse, nonsensical whim of his own. Against all such noxious insects the law should declare a war of extermination, and enforce it by every practicable and lawful means available. The amount of the earth's produce which would thus be saved from destruction for the use of the nation would far more than cover the cost attending the supervision of the destructive insects of the country by a properly equipped staff of officials. Until some such powerful means are taken under proper legal authority to rid the country of insect pests, the crops of the careful and industrious members of the community must suffer seriously from the injury inflicted upon them by the insects which are permitted to exist and multiply on those of their careless or ignorant neighbours. Education of the masses will in time give the people more correct notions upon this matter, as well as upon many other common affairs of every-day life, but it is not so much for the ignorant as for the wilfully perverse and careless that laws require to be made.

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THE seventeenth annual report of Mr. Juland Danvers, Government director of the Indian Railway Companies, has just been presented to Parliament, and we gather from it some points of interest for arboriculturists. He points out very forcibly the great danger in a national aspect arising from the consumption of wood as fuel for the different lines, and the shameful waste thereby entailed, as well as the serious consequences which may befall our whole Indian Empire if, with the future extension of the various networks of railways in the East, the present system of using wood for fuel should become more widespread, which, with such a contingency, is most likely to occur. It is hoped that some arrangement may be made by which the cost of bringing the coal by sea from Calcutta to Madras may be reduced. The difficulty of procuring wood is becoming greater every year, and the use of it is open to many objections. The frequently recurring famines which we are so sadly accustomed to hear of in India, and the scarcity which is now threatening with starvation the millions of the Madras Presidency, are due to a drought which is in great measure attributable to the diminution of the forests which once covered the country. When we hear of the vast plains stretching as

far as the eye can reach, and appearing like a boundless ocean of waving grain, we are apt to forget that the very extent of the fields covered with these rich crops is in itself evidence on what a precarious thread the harvest depends. Could we but see more of the arable land given up to forest, then, in the provision made for the natural circulation of moisture, in the return of it to the atmosphere by local evaporation, and again in the attraction of it to the thirsty plains by the towering trees, we should know that a better safeguard had been secured against drought than even a complete network of irrigation canals throughout the peninsula could give us. For centuries on centuries this destruction of forest has gone on, and it is only within the last few years that the Government has taken proper steps to remedy it. But the ravages of the railways, so long as they depend on wood for their fuel, are greater than any which have been previously experienced. The smaller branches are useless for the locomotive engines, and as the firing is frequently brought from a great distance, where roads are rare and carriage is scarce, all but the larger logs are left to rot upon the ground, and the waste and damage are increased tenfold. There is another, though far minor objection to the use of wood for railway fuel. Notwithstanding that the engines on the Indian railways are provided with a fine wire cover over the funnel, the light sparks are blown through it by the powerful draught, and, setting fire wherever they fall, frequently cause much mischief. There is much less danger from the heavier cinders of coal. A new inconvenience has now been discovered, though it seems to be confined to wood obtained from Scinde. It was found that the copper fire-box of the engines rapidly wore out. Specimens of the corroded metal, as well as samples of the babool wood used as fuel, were sent to England. Dr. Watson, of Manchester, has analyzed them, and reports that the rapid destruction of the plates is due to the presence of chloride of sodium as one of the mineral constituents of the wood, the injurious effect being increased in proportion to the height of the temperature at which the plates are exposed to the action of the noxious gases. The source of this saline ingredient in the wood is being investigated, and inquiry is being made into the character of the soil where the trees were grown, and into any peculiarities of the atmosphere. It is earnestly to be hoped that some economical plan may be devised for employing coal on all the lines throughout the country.

A FEW words about ourselves may not be uninteresting to our readers, and will, moreover, be for us an easy way of answering the many kind inquiries about our success, which we are constantly receiving from

various quarters. Thanks to the untiring energy of the small body of gentlemen with whom the idea of a *Journal of Forestry* originated, supported by our talented contributors, and aided in some measure, we hope, by our own hard work, our subscribers' list now includes the names of many of the largest landed proprietors, the foresters in charge of the principal estates in every part of the United Kingdom, with not a few of those in foreign countries to whom forestry is a special attraction. Nevertheless, in order to carry on the Journal with that vigour and spirit which alone can make it a complete success, we want more support and a much wider circulation. For this, we are convinced, we must rely in great measure on the good offices of our readers. There are still hundreds of foresters and others interested in arboriculture who have never yet heard of the *Journal of Forestry*, and many of these can only be reached through their friends and neighbours. It is for this purpose that we have enclosed a couple of prospectuses in each copy of this number of the Journal, and we sincerely hope that by passing these round amongst their friends, every subscriber will have been able before the issue of our next publication, to add at least one more name to the list. Any one who is willing to help us more extensively can have a further supply of these prospectuses sent by applying to the publishers, who will moreover gladly forward a specimen copy, post free, to any names which may be forwarded to them. If in this way each one will help us a little, our readers may rest assured that we shall not slacken our efforts to make the *Journal of Forestry* a complete success, and to maintain it as an organ which foresters will be proud to recognise.

Cultural First Principles.

By G. S. BOULGER, F.L.S., F.G.S., Late Professor of Natural History in the Agricultural College, Cirencester.

The existing books on forestry published in this country are lamentably deficient in scientific principles. They are mostly heterogeneous collections of personal experiences in limited areas in Scotland. Brown's "Forester" alarms the student by asserting the necessity of his having a knowledge of chemistry, geology, botany, vegetable physiology, and some zoology, besides French and German, and possibly other subjects which have escaped my memory at present, leading him to suppose that he requires a thorough knowledge of the technicalities and masses of facts embraced by these branches of learning, instead of a knowledge merely of their leading principles. These leading principles, so far as they have any bearing on forestry, might well be set forth in a manual of such bulk as the one above mentioned; but had we a suitable national institution for the thorough training of foresters, it would be better still to have a uniform series of smaller text-books on the sciences and arts pertaining to forestry. Another blemish hinted at above in existing works is the want of any general view of the subject. Scotch foresters write as if their methods of cultivating a few thousand acres were indispensable all the world over; French and German foresters take but a slightly wider grasp; whilst our Indian officials reflect in their teaching whichever of the two latter schools they may have been trained in.

There are, however, certain principles equally true of all climates, others equally true of all soils, others equally true of all trees, and others equally true of cultivation, both on a large and on a small scale. Starting from the economical first principle laid down in my last article, that we should grow the most valuable species in the most suitable climate and soil, with the right amount of room and shelter, and as near as possible to the best market, we arrive at the first cultural principle, viz., that the treatment of a forest depends on the climate, the soil, and the nature of the trees to be grown. Proximity to market being a question of finance or economics, is only indirectly related to cultivation.

With regard to climate, the forester requires to know merely the rudimentary facts and principles of meteorology; but it would be well if a thorough weather chart were kept on every large estate. The apparatus necessary is neither extensive nor costly; a rain gauge, a barometer, a thermometer, an hygrometer, and a weathercock being obtainable for a total outlay of but a few pounds, and the method of recording observations easily learnt by any intelligent man. The elevation above sea level, proximity to the ocean, or to a mountain-range, aspects, slope, and mechanical composition of the soil of a forest, large or small, are all important. The fundamental fact—groupings as to climate—is so admirably set forth in the "Manual of Sylviculture" of Professor Bagneris, of Nancy, which has been published in English at Madras, that as the book is not commonly seen in this country, no excuse is necessary, for the following abstract of this portion of it:—

"The climate of any spot may be defined as the state of the surrounding atmosphere as regards (i.) temperature, (ii.) the intensity of light, (iii.) the degree of moisture, and (iv.) the prevailing winds. These four factors, which go to make up climate, are determined by various causes, of which some are general or geographical, but the more important are special or local disturbing causes. Geographically, climate depends on latitude; but the disturbing causes are so numerous that, practically, latitude has but little to do with its determination. These disturbing causes constitute 'local climate,' which depends mainly on two things, 'situation' and 'aspect.'

"The *situation* of a place is its position with regard to the sea, including its distance from it and its height above it.

"The *aspect* of a tract of land is its inclination towards one of the points of the compass. Thus the distance from the sea in the direction of prevailing winds is one of the determining causes of rainfall, more evaporation taking place from the sea than from the land, and more rain, therefore, falling near the coast-line. The rainfall at Bristol, for example, is nearly twice that at London. So, again, the irregular shape of oceans and continents has a vast effect on the temperature of various places, *i. e.*, on the distribution of heat over the globe. Places having the same mean annual temperature, as is generally known, are termed 'isothermal,' and lines connecting them "isotherms." A warm current in the Atlantic Ocean deflects the isotherm of 62° F. mean July temperature more than 15° of latitude north of its course, so that New York, in the latitude of Madrid, has the same mean annual temperature as London.

"The *climate of plains* is generally milder and more uniform than that of mountains. It varies with the elevation of the plain as regards temperature, the proximity of the ocean and of mountain-

chains, and is further modified by the nature of the soil, the presence of lakes, large rivers, or other sheets of surface water, and of forests.

"The *climate of mountains* is subject to the same modifying causes, with the additional influence of aspect.

"*Elevation* chiefly affects temperature, but as one gets higher the air generally becomes drier as well as cooler, and winds are naturally more violent.

"The *effect of elevation* is seen in the forest vegetation, which, vigorous in the plains, is less active on the hill-slopes, becomes sluggish and dwarfed, until on high, unsheltered plateaux it even disappears altogether.

"Besides increasing the atmospheric humidity, and consequently the rainfall, *proximity to the sea* exposes a place to the full violence of the wind. So also one of the chief influences of neighbouring *mountain-chains* is to break the force of the winds.

"The *nature of the soil* affects the humidity of the climate in proportion to its compactness; the more compact a soil is, the less hygroscopic it will be; that is, the less water will it absorb or retain. Secondly, the colour of the soil renders it more or less capable of absorbing heat; thus a dark soil will absorb more and reflect less heat than a light-coloured one, and will thus in itself be warmer, but will render the surrounding air cooler.

"*Surface water* (i.) by its evaporation makes the air moist and (ii.) lowers the summer temperature; but (iii.) its vapour, in the form of fog, intercepts the sun's rays, and is therefore liable to bring on frost. As, however, it is less rapidly affected by changes of temperature than the air, it may (iv.), by cooling more slowly than the air, diminish the cold in the beginning of winter, but will similarly (v.) diminish the heat in spring. (vi.) Sixthly and lastly, it offers no obstacle to the wind.

"*Forests* (i.) by their shelter prevent evaporation; but the watery vapour exhaled by their foliage more than counteracts this, lowering the temperature in spring and summer, the growing season. (ii.) In winter they present an obstacle to the radiation of terrestrial heat thus diminishing the cold, so that (iii.) their general effect on temperature is to prevent or lessen sudden changes. Wooded districts (iv.) have more frequent if not more rain than other places, and the forests act (v. as a barrier against wind.

"*Aspects* are grouped as four, according to what are known as the 'cardinal' points of the compass, which we will consider separately and apart from such local modifying conditions as those of steep valleys, extreme elevations, and sheltered localities.

"A *northern aspect* receives no sun; the heat is, therefore, feeble, and the light diffused; the winds are cold, contain but little moisture, and are never strong. The temperature, however, being low, the

moisture in the soil evaporates slowly, so that plants grow rapidly. The woody tissue is therefore soft, and not well ripened as timber. Wood may, therefore, be grown on a north aspect for planking, but not for building timber, beams, &c.

"On an *eastern aspect* the sun strikes obliquely during the coolest hours of the day, so that the temperature and the light are moderate. The wind is dry and violent. The soil under these conditions keeps fairly moist, so that tree-growth is moderate, and the timber not too soft, but fairly lignified or matured. The eastern aspect is the best, timber grown on it being fit for all purposes.

"Tree-growth not being rapid on northern and eastern aspects, there is little danger of spring frosts, but more of early autumn ones.

"On a *south aspect* the sun shines almost all day, so that the temperature is high and the light intense. The winds are strong, and often bring heavy storms, so that the ground is alternately soaked and dried up. Being washed down the slopes by the rain, it is generally superficial only, under which conditions timber can only grow slowly, and often becomes misshapen. It is, however, well matured and useful for building when sufficiently shapely.

"On a *western aspect* the sun strikes obliquely, but during the hotter half of the day, so that the temperature is high and the light fairly intense. The soil cannot long retain its moisture, and the winds being like those of the southern aspect, timber is here also slow in growth and ill-shapen.

"Independently of their causes, we can draw up a *classification of climates*, as hot, mild, temperate, cold, and very cold. This classification was originally made for France, and the first class, the *hot climate* the home of the cork and evergreen oaks (*Quercus suber* and *Q. ilex*) is not represented in Great Britain.

"The *mild climate* is characterized by the common oaks (*Q. sessiliflora* and Q. *pedunculata*), fruiting every year. This is only slightly represented in England and Ireland.

"In the *temperate climate* these oaks and the beech only fruit once in four, six, or even eight years. The hornbeam and beech are frequent. Most of England south of the Humber may be considered as temperate.

"In the *cold climate* the beech grows with the Scotch, and in France the silver fir. Most of Scotland comes under this head.

"In the very cold climate, represented by the north of Scotland and by mountains farther south, the beech gives place to the birch, and the spruce and larch are more at home than the Scotch fir."

Such being an outline of the subject of climate, so far as it requires the attention of the forester, the consideration of soil may be reserved for a future article.

Remarks on the Thinning and Pruning of Forest Trees.

By ALFRED J. BURROWS, Pluckley, Kent.

The neglect of the proper thinning and pruning of forest trees is so general that it must proceed from either a want of knowledge of the principles of vegetable physiology, or from carelessness in the application of that knowledge which science places within the reach of the forester. If the object of the planter be merely the growth of the maximum of wood upon the minimum of space, irrespective of shape and quality, then may the pruner consider his "occupation gone," as every branch cut away from the tree, by lessening the quantity of foliage presented to the action of the sun and atmosphere, lessens also the absorption by the leaves of carbonic acid gas, and thereby proportionally decreases the formation of carbon, which composes the skeleton or framework of the tree or plant. If, on the contrary, the forester has in view the largest possible production of straight, lengthy, clean-grown, and sound timber in the shortest time and upon the smallest area, then must the work of thinning and pruning commence a few years after planting, and continue until the trees have almost reached their maturity. Where he has also in view the reproduction of the forest without the labour and expense of planting, his work will be continuous, as such a gradual clearance must be effected as will favour the germination of seed, and the progressive filling up of small spaces cleared by the woodman's axe.

In a carefully tended and well-managed plantation every tree should be sound and healthy, whereas in neglected forests unsoundness becomes the rule, and not the exception. So frequently is this the case in a state of nature that Canadian woodmen, or "lumberers," find that not one tree out of thousands growing in their forests is fit for exportation.

As the growth of sound and valuable timber is so greatly dependent upon the proper attention of the forester, who should under all circumstances be guided by the principles of true science, and as an intimate acquaintance with the habits and food of trees and plants is so essential to his success, a few preliminary remarks may not be out of place before we describe the more mechanical acts of thinning and pruning.

It is well known that all vegetables take in their liquid food mainly from the soil, and their gaseous supply chiefly from the atmosphere; and though some of their inorganic elements are derived immediately from the soil, carbon, which forms one-half the weight and nearly the whole bulk of the tree, is obtained directly from the atmosphere through the pores of the leaves.

Chemistry proves beyond a doubt that over equal areas in the same latitude, which necessarily receive equal amounts of light and heat, similar quantities of carbon are obtained from the atmosphere by the crop of vegetation, whether it consist of the lofty forest trees, or the lowly and almost recumbent clovers or grasses; and since weeds which are indigenous to the soil are so much more rapid in their growth than the cultivated plants, they must obtain the largest share of this vegetable food—a strong argument in favour of clean cultivation, whether in the nursery, garden, plantation, or upon the farm.

The careful analysis of an ordinary piece of wood which has been dried at a temperature of 212 degrees proves that one-half its weight consists of charcoal, which is again subdivided into carbon, and from one to five per cent. of ashes or inorganic matter. These ashes are made up of lime, potash, and a few other ingredients. Every 100 parts of atmospheric air contain about twenty of oxygen and eighty of azote, which latter merely acts as a diluter of the oxygen. Carbonic acid gas is present in the proportion of one in 2,500. This carbonic acid is composed of one of carbon, combined with two and two-thirds its weight of oxygen, and is decomposed by the leaves under the action of light, the leaves retaining the carbon and giving off the oxygen. During the night, however, the process is reversed, as the leaves then absorb oxygen and give off carbon, though in very small quantities. This will account for the great rapidity of growth of vegetation in those latitudes where the sun never sets for weeks and months together, the continual absorption of carbon forcing it on very rapidly. By the decomposition of ammonia plants obtain their nitrogen.

Johnson, in his "Elements of Agricultural Chemistry," tells us that upon lands of average fertility, from one-third to four-fifths of the entire amount of carbon contained in the crop is obtained from the air; and that to catch the small amount of carbonic acid "the tree hangs out thousands of square feet of leaf, in perpetual motion through an ever-moving air, and thus by the conjoined labours of millions of pores the substance of whole forests of solid wood are slowly extracted from the fleeting winds." The same authority also tells us that upon a square inch of surface of the common lilac leaf 120,000 of these pores have been counted, and upon an oak tree 7,000,000 of leaves.

The liquid food of the tree being largely derived from the soil, an undue cutting away of roots will considerably diminish the quantity of foliage in the following spring; and this again reacts upon the tree in causing a great diminution of wood growth.

The liquid food, or crude sap, enters the spongioles through their countless pores, passes along the roots, and ascends the sapwood of the tree, passing through the branches to the leaves, where, by the action of light and an admixture of carbonic acid, it is elaborated into the true sap, a portion of the moisture being given off by evaporation. This sap afterwards descends through the inner bark, forming the new layer of wood. That the wood is formed during the descent of the sap will be apparent to all who observe the large lip or swelling which forms on the upper part of the section of the severance, or the enlargement of the sapling above the parts where it is embraced by the woodbine. The new wood of the tree is laid on externally, and the new bark internally.

Some trees, such as the plane and birch, shed their bark annually. The starch which is formed in the new sapwood is carried up by the ascending sap of the following spring to develop the buds and blossoms.

Having made an intimate acquaintance with the laws which govern vegetable life, the forester will exercise a wise discretion in using his axe and pruning-knife, and study closely the requirements of the trees under his care.

For thinning trees no precise rules can be laid down. The guiding principles should be to prevent all nurses overtopping or whipping the standard trees, and ultimately to give every permanent tree sufficient space to enable it to develop a well-proportioned and healthy head, equal in length to one-half the height of the entire tree. Or, where the production of lengthy and quick-growing poles is aimed at, the preservation of a complete canopy of leaves overhead should be secured, which will so distribute the sunshine that it shall fall upon the ground riddled, and not in large patches. Much must depend upon the climate and soil in fixing the proper distances apart at which trees should stand.

Where they have been planted in rows the work of thinning and clearing will be greatly facilitated, and regular intervals can be thus assigned to the standards.

Thinnings should always be lighter round the margins of plantations, especially in the directions of prevailing winds. The directions from which these winds come may easily be ascertained in any district by noticing the position of uprooted trees. If such winds come from the south and west, thinning should commence from the north and east. The violence of the prevalent winds must be the

forester's guide in proportioning the breadth of dense belt to the size of the plantation. By the exclusion of violent winds the fallen leaves are not drifted, but decay *in situ*, and thus keep up an even fertility of the soil.

Thinnings should never be so severe as to expose long poles, clothed only with a tuft of branches at the top, to the violence of the wind. Even when such standards, after being bent to the ground, are placed erect again by a lightening of the top, they seldom produce anything but an ill-shapen tree. If the length of the bole be greatly disproportioned to its size and strength, the exposure of such a tree is generally fatal to the attainment of well-formed timber. Carefully executed thinnings, by preserving the leaf canopy, and thereby excluding intense sunlight, tend to favour the preparation of the ground for the seedling crop, so essential in the cultivation of high forest.

Thinnings, like prunings, can be best arranged, if not actually carried out, during the summer: the weight of foliage then indicates more accurately when mischief is being wrought. Judicious thinnings favour the production of seed; but when it is intended to have a good crop of seedlings in the spring, most of the scrub must be removed, so as to admit heat, without which the seed decays before germinating.

Pruning requires to be executed with great care, and with no small amount of judgment. Trees in their natural habitat, and under favourable circumstances, develop a handsome head and fair proportions, with little aid from man. A system of natural pruning, by which the upper branches slowly and almost imperceptibly destroy the lower ones by the exclusion of light, is constantly going on, though the result of this is often unsoundness of stem. When the object in view is the production of sound, clean, straight-grown timber, a timely pruning of the lower branches must be made. A greater length of bole, and consequently a much larger yield of valuable timber from a given space, will be the result. By increasing the height of trees and the length of stem, the effects of shade are considerably lessened, and a much larger and stronger crop of seedlings may be expected. In continental forests, as well as in those of India, where a system of natural reproduction is carried out, great attention is paid to both thinning and pruning, and an even and luxuriant crop of seedlings is the result.

Where a full canopy of foliage is preserved in thin plantations, but little side pruning of the standards will be required; but where such a clearance is effected as to admit abundant light and the full force of the sun to the boles of the remaining trees, the dormant buds will soon develop into epidermic or trunk branches, and pruning will become necessary. Every careful observer of growing timber will

discover that amongst coppice standards there is a far greater proportion of unsound and stag-headed timber than is to be found among the produce of forests and our hedgerows. No sooner is a clearance of the adjoining timber made than upon the trunks of nearly every such standard a plentiful crop of side branches spring into life; the flow of the sap to the head of the tree is arrested, and decay of the crown sets in, resulting in stag-headedness and rot. The top branches dying off, unsoundness of crown follows; the water percolates through the trunk, and often makes its way to the very roots. A timely removal of these branches during the second year of their existence, by a clean cut close to the stem, will generally save the tree. It should be borne in mind that these epidermic branches only rob the crown of its sap, and do not in any way add to the bulk of the tree's foliage, or to its permanent enlargement.

The close study of a well-grown and flourishing tree shows that—beginning at the top—the junction of each branch with the main stem is attended by an increased bulk of trunk, proportioned to the size of the inserted branch and the amount of foliage it bears. Such being the case, the removal of every branch, except in cases of great overcrowding or very dense growth, must seriously impede the general growth of the tree, and should be undertaken only when absolutely necessary. Any branch which causes a powerful diversion from the uprightness of the main stem should unhesitatingly be taken away. A rival leader should also be cut clean out. Where it becomes necessary to remove a branch close to the trunk, a clean section should invariably be made. However, it will often be advisable to lighten a primary branch by the removal of part or nearly the whole of its secondaries. No branch with a greater diameter than 3½ or 4 inches should ever be cut off close to the stem, unless the tree itself is intended soon to come down. Larger ones should be taken off at a distance of two feet from the trunk, and in such a manner as to leave near the extremity of the stump a growing branch of not less than an inch in diameter. Extension of decay to the trunk is thus arrested.

Where heavy pruning of trees is resorted to, it is better to extend the operation over two or three years, as in such cases the crop of epidermic branches is much less abundant, the checking of the flow of sap to the head being more gradual.

From Midsummer to November is the best time for pruning deciduous trees. Winter pruning is generally followed by a plentiful crop of side branches; and spring pruning causes unnecessary bleeding. A judicious and timely pruning will often prevent accidents from winds and other causes. Still the fact should never be lost sight of that every branch not only increases the size of the trunk, but also promotes the formation and development of roots.

The pruning of timber trees overhanging arable land is often resorted to for the benefit of the under crop; but the general unsightliness of such trees, and the frequently hideous appearance of their mutilated trunks, should go far towards recommending their entire removal where they become a nuisance.

In coppices, where the growth of the underwood is very rapid, it will often spring up in time to stamp out the growth of the epidermic branches upon the standards.

In plantations of the fir tribe it will often be necessary to remove rival or injured leaders. Where these trees stand close together, and the lower branches die off, it is always better to remove them by a timely pruning close to the trunk, taking care not to injure the bark, as the bolt-like insertion of the decayed branch is very injurious to the tree.

Every cut with the pruning-knife or chisel should leave a clean smooth section, and afford no lodgment for water. To insure this, where a branch is removed at some distance from the trunk, the upper part of the section may overhang a few inches.

Independently of the largely increased profit accruing from well-managed timber, there is in the appearance of a lofty forest, a well-assorted group, or a single stately timber tree, a grandeur and a beauty which amply repay the cultivator. Many an admirer of nature, in surveying a well-shaped and colossal specimen of the Forest King, whose "embryo vastness at a gulp" the "thievish jay" was not allowed to swallow, has felt the full force of the lines in which Bryant apostrophises it:—

"This mighty oak
By whose unmovable stem I stand and seem
Almost annihilated—not a prince,
In all that proud old world beyond the deep,
E'er wore his crown so loftily as he
Wears the green coronal of leaves with which
Thy hand has graced him."

Coniferæ at Hawkstone, Salop.

By J. JANDRELL, Forester, &c.

In accordance with your wish, I now send you a brief account of some of the rarer Coniferæ growing on this estate. There are great quantities of them growing luxuriantly in nearly every description of soil and situation. I will therefore only pick out a few of the specimen trees, and report upon them. We will first take the—

Wellingtonia gigantea.—No. 1 is growing on a lawn in front of the old home farmhouse, it having been planted about 12 years, and being about 8 feet high when planted. It is now over 40 feet high, growing in a beautiful symmetrical form, closely resembling a sugarloaf, with a spread of branches a short distance above the surface of the ground of 17 feet. It is most remarkable that it should thrive so well, having only a few inches in depth of good loam to grow in, resting upon the red sandstone formation, the sandstone rock cropping out on the surface about 30 yards from the tree. No. 2 is growing in the gardens at Hawkstone, it having been planted about 26 years ago, being about 5 feet high when planted. It is now over 50 feet in height, having a spread of branches of 18 feet a few inches above the ground, and a circumference of stem 10 feet at the surface. Another good specimen within a short distance of the above is over 45 feet high, with a spread of branches of 20 feet. They are planted in a deep rich loam, with a clayey subsoil.

Cupressus macrocarpa.—No. 1 is growing in the gardens at Hawkstone. I cannot obtain any reliable information as to when it was planted. It is now about 60 feet high, and growing in beautiful form, with a spread of branches in centre of tree of 20 feet. There are seven more of the same variety within a short distance of the above, the average height of which is 45 feet. They are planted in a deep rich loam, with a clayey subsoil. No. 2 is growing on the terrace at Hawkstone. It has been planted about 15 years, being about 4 feet high when planted. It is now over 50 feet high, having a spread of branches in centre of tree of 15 feet. It is planted in a light sandy soil, with the red sandstone formation directly underneath, the rock coming to the surface about 14 yards from the tree.

Araucaria imbricata.—No. 1 is growing on the highest and mos

exposed part of the terrace. It has been planted about 32 years, being about 4 feet high when planted. It is now over 35 feet high, and thickly furnished with branches, the spread of which in the widest part is fully 18 feet. This is the female variety. It is planted in a sandy loam, at an elevation of about 600 feet above mean sea level. No. 2 is also growing on the terrace. It was planted at the same time as No. 1, and is situated within a few yards of it. It is now over 40 feet high, with a spread of branches, measured a few inches above the surface of the ground, of 16 feet. There are quantities of the same species growing well within a short distance of the above trees, the smallest of ten of them being about 25 feet high.

Pinus cembra.—There are two good specimens of this variety growing on the terrace within a short distance of the Araucarias; they are both about 35 feet high, with a spread of branches in centre of tree of 15 feet. They are thickly covered with foliage, and are growing in a beautiful conical form. These were planted about the same time as the Araucaria, 32 years ago.

Abies Smithiana, or morinda.—No. 1 of this variety is growing on the terrace, within a few yards of the *pinus cembra.* It is very healthy, and is growing in splendid form. It is now about 45 feet high, having a spread of branches a few inches above the surface of the ground of 23 feet. This was planted at the same time as the Araucarias, and is situated in the same description of soil. No. 2 is growing at a distance of about one and a half mile from the above-named specimens, and was planted about the same time. This is growing in a good loam, with a clay subsoil. It is now about 50 feet high, with a spread of branches of 19 feet.

Sequoia (Taxodium) sempervirens.—No. 1 is growing on the terrace within a short distance of No. 1 *Abies Smithiana,* this also having been planted about 32 years ago. It is growing in a sandy soil, with the sandstone rock within a short depth of the surface. It is now 40 feet high, with a circumference of stem a few inches above the ground of 6 feet. It is thinly clad with branches, the spread of which in the widest part is 20 feet. The peculiar appearance of the bark renders this a very remarkable and interesting specimen. The bark is of a spongy nature, and very like the outside rind of a cocoa-nut. No. 2 is growing in the old vineyard close to the terrace, it being planted about the same time as No. 1. It is growing well, having made a good leading shoot this year. It is planted on the side of a hill having a gradient of about 1 in 3. It is now about 55 feet high, having a spread of branches of 28 feet. There are ten more of the same species within a few yards of the above, the smallest of the ten being about 35 feet high. The whole

of these are growing in a good deep loam, but they possess in a much less degree the spongy nature and appearance of the bark as seen in No. 1 specimen. This I attribute to the better class of soil, and to a lower elevation.

CRYPTOMERIA JAPONICA.—No. 1 is growing on the terrace, it having been planted about 26 years ago, being about 4 feet high at that time. It is now 40 feet high, with a spread of branches of 18 feet. It is growing in a good loam with a sandy subsoil, and the sandstone rock immediately underneath the subsoil. No. 2 is also on the terrace. It is situated a short distance from No. 1, and was planted at the same time. It is now 38 feet high, having a spread of branches of 18 feet. There are six more of the same species situated within a few yards of No. 2, the smallest of them being about 35 feet high.

CEDRUS DEODARA.—There is a large number of this graceful cedar planted here, and the greater part of them are very fine specimens. I have found very great difficulty in fixing upon what would be considered the best specimens. I have, therefore, chosen No. 1, not because it is the highest tree, but for it being the most beautifully clothed with gracefully drooping branches and charming foliage. It is growing on the terrace, having been planted there about 26 years ago, being then about 4 feet high. It is now 50 feet high, and very thickly furnished with branches, and is growing in a beautiful symmetrical form, the spread of branches a few inches above the surface of the ground being 30 feet. It is planted in a good deep loam with a sandy subsoil, having the sandstone rock immediately below the subsoil.

CEDRUS ATLANTICA (MOUNT ATLAS CEDAR).—There are quantities of this free-growing species or variety of cedar grown here, all very fine specimens. The one I have chosen for my remarks is also growing on the terrace. It was planted at the same time as the Deodar, and is situated within a short distance of it. It is now 53 feet high, thickly covered with branches and foliage, the spread of which in widest part is 32 feet. It is growing in a good deep loam, with a sandy subsoil.

PINUS BENTHAMIANA.—This specimen is also growing upon the terrace, and is situated amongst the cedars, it having been planted at the same time. It is a very healthy tree, doing well, being now 58 feet high, having a spread of branches of 24 feet and a circumference of stem a few inches above the ground of 6 feet.

PINUS EXCELSA.—There are many specimens of this beautiful conifer also growing upon the terrace. The one that I have selected is within a short distance of the last-named species. It was planted at the same time, and it is now 53 feet high, growing in good form, and thickly covered with branches, the spread of which, a few inches above ground, is 30 feet.

Picea Nordmanniana.—Several excellent specimens of this handsome conifer are growing on the terrace, and the two that I have selected are situated about the centre of it. They were planted at the same time as the cedars, 26 years ago. No. 1 is 53 feet high, with a spread of branches a short distance above ground of 30 feet, No. 2 is 50 feet high, with a spread of branches of 32 feet. There are eight more of the same species within a short distance of the above, the smallest of which is over 32 feet high. They are growing in a good loam with a clayey subsoil, and with the sandstone rock underneath the subsoil.

Picea pinsapo.—This species of the coniferous tribe forms a very symmetrical and handsome tree, and I think most of your readers will agree with me in considering it the most beautiful of all the hardy Coniferæ. There are several specimens of this species growing upon the terrace. The two that I have selected are situated a short distance from the *Picea Nordmanniana.* No. 1 is 35 feet high, with a spread of branches a few inches above the ground of 24 feet. No. 2 is 33 feet high, with a spread of branches of 27 feet. They are well covered with branches and foliage, and are growing in beautiful form. They were planted at the same time as the *P. Nordmanniana,* and are growing in a good loam, with clay subsoil.

Thuja Menziesii (Lobbii).—This is a specimen tree growing in the Home Nursery. It is planted in a strong loam with clay subsoil, it having been planted 18 years ago, being then about 4 feet high. It is now 35 feet high, having a spread of branches on the surface of the ground of 21 feet. It is a handsome variety, being thickly covered with graceful foliage.

Juniperus Virginiana (Red Cedar).—This variety is also planted as a specimen tree in the Home Nursery, it having been planted at the same time and near to the *Thuja Menziesii,* and in the same description of soil. It is now 32 feet high, and growing in a beautifully compact form, having a spread of foliage of only 6 feet.

Cupressus Lawsoniana.—This handsome variety of conifer is growing in the gardens at Hawkstone. It was planted about the same time as the Wellingtonias that are growing there. It is growing very freely and in fine form. It is now 35 feet high, with a spread of branches a few inches above the surface of the ground of 20 feet. I think one of the prettiest sights to a lover of the beautiful is to see this variety in flower, several of the specimens here having flowered this spring. They were, literally speaking, covered with bloom, giving the trees, with their miniature red flowers, quite a brilliant appearance. In concluding this report allow me to say that I know some of your readers have finer specimen Coniferæ under their charge than those I have reported upon, especially some of the earlier

introduced sorts, and such others as rare old cedars, &c., of which we hope to see a report in your pages in due course from time to time.

It will be observed that the majority of these I have reported upon are, strictly speaking, of "modern" planting. The report also shows that many of the species introduced from foreign countries thrive exceedingly well in our very changeable English climate.

The Australian Bug.

The report of the Australian Bug Commission presented to the Cape Parliament shows that this destructive insect has now settled not only in Cape Town, but in Simon's Town, Stellenbosch, Paarl, Wellington, Namaqualand, George, Uitenhage, and East London. Its distribution appears to have been effected by the agency of living plants or fresh fruits, supposed to have been brought from Australia to Cape Town, where it first made its appearance in this colony, and, in evidence of the irregularity of its dispersal, it is mentioned that, although it was observed in the village of O'okiep, Namaqualand, a few months after its first discovery in the Cape Town Botanical Gardens in 1873, it was not seen in the neighbouring division of Stellenbosch till the latter end of 1876. Several birds and insects have been suggested as destroyers of the *Dorthesia*, viz, black and red ants, bluebottles, the white-eye (*Zosterops Capensis*), the larvæ of ladybirds and lacewing fly, English sparrows, Cape sparrows, domestic fowls, and turkeys. Of these supposed enemies no satisfactory evidence has been given except in the cases of the ladybird and the larvæ of the lacewing fly. The other insects rather protect the bug for the sake of a sweet fluid which it yields. Of the birds, *Zosterops* is the only one likely to be of service, but hitherto it has shown no particular liking for the abundant and conspicuous *Dorthesia*. Sheep-wash is recommended as a good specific, and also a mixture of soap and turpentine. In order to enforce the eradication of the pest it is recommended by the majority of the Commission that a bill should be introduced into Parliament compelling, under penalty, every owner or occupier of lands who finds the *Dorthesia* on his grounds to report the same at once to the Divisional Council, field-cornet, or other public body of persons appointed by Government in that behalf, who shall thereupon cause the infested place to be inspected, and instruct the owner or occupier to cut down and destroy the whole, or such part as may be deemed necessary, of the trees or shrubs infested; and, in case of refusal, cause the same to be cut down at the cost of the owner or occupier. Dr. Atherstone suggests a premium of a penny a hundred for mature specimens.

The Forests of Russia and their Products.

By JAMES RUSHFORTH.

It should be remarked that timber in Russia figures among the most important items of foreign trade, and ranks third among the staples of Russian exports. When we consider besides, the enormous amount of wood that is consumed in the towns and the interior of the country in various forms, the timber resources of the empire must be enormous; yet, says a Russian authority, although latterly there has been a marked increase in the number of saw-mills in the forest districts, it cannot be said that the Russians have reaped all the advantages to be derived from these natural riches. According to statistical data there are in European Russia alone 172,418,000 dessiatins (about 400,500,000 acres) of forests, or 43·3 per cent. of the entire territory. Such an extent of forests is not to be found in any other country of Europe. Two-thirds, or 66 per cent. of the mass of forests extend over the north-eastern districts, then follow the north-western governments, where the relative proportion to the general area is 30 to 50 per cent. In the middle Volga, the Baltic, and western and central provinces the proportion is 27·2 per cent.; in the south-western provinces it is 2·5 per cent.; in the Little Russia and Steppe governments, 1·6 per cent.; and in the southern governments, including the Crimea, it is only 0·7 per cent. Here are not included Finland and the Caucasus, which contain splendid timber in great variety, nor the Polish governments, where the forests occupy a very extensive area.

We will here enumerate the most noteworthy species of trees usually met with throughout the Russian empire. The common pine, or Scots fir, extends very far north in Russia; it is found also in the south—in the Crimea and the Caucasus. It is noteworthy that the difference of locality has an enormous influence on the longevity of the pine. There are many examples of these trees reaching an age of 300 years or more. In the northern provinces, the trees which are cut down for masts are mostly from 200 to 250 years old. Of these, the oldest tree will measure, at the thickest part of the trunk, 32 in. in diameter and 63 ft. in height, up to where it is cut off at the top; the youngest will measure 28 in. in diameter at the thickest part of

the trunk, and 70 feet in height. The spruce fir tree extends further north than the pine, but remains behind it in the south. These two species of trees—in the shape of hewn wood and timber, and sawn and split wood—form, owing to the variety and usefulness of their application, one of the most important staple commodities of Russia, and reach this country through the ports of Archangel, St. Petersburg, and Riga.

As a comparative novelty in the export trade of Russia, may be mentioned larch timber. In the forests of Russia the European larch, properly speaking, is not to be found; instead of it grows the so-called "Siberian larch." This latter species differs very little from the former in a botanical sense, so that botanists formerly regarded these trees as belonging to one and the same species, and even now there are many who regard the Siberian larch as only a distinct variety of the other. The Russian larch reaches enormous dimensions both in height and thickness, the trunk being rounder than that of the European species. The Russian or Siberian larch grows principally in Siberia and in the vast district through which flows the Petchora River, forming the north-eastern corner of Russia, and part of the government of Archangel, which distant territory it would appear has been neglected for upwards of half a century. Quite recently a commission was appointed to investigate its natural resources, among which the larch tree engaged the special attention of the commissioners. We learn that the larch of the Petchora country grows on rich soil, mainly on the banks of the rivers, and spreads, although not continuously, all over the locality. The timber of this variety of the larch is exceedingly strong, and is very much prized in Russia as a substitute for oak in shipbuilding. Lieutenant-General Amasoff, the Inspector-General of Shipbuilding at Cronstadt, makes the following observation on this subject:—"Ships of the line, frigates, and other vessels, as well as screw steamers, have been built at the port of Archangel exclusively of larch, with the exception of a small portion of oak, which was used for some of the parts where curves were required, where larch, owing to its straightness, could not be employed. The vessels built of larch at Archangel lasted, up to their first general repairs, from 13 to 22 years. In taking the vessels to pieces it was invariably found that the larch was in a better state of preservation than the oak timbers, owing to the tannic acid contained in the latter, which tends to corrode the iron bolts, &c.

"Up to the present time it has been the fashion in constructing iron-clads to use teak backing for the iron plates, which is not only liable to rot, but is subject to the attack of a peculiar kind of worm. Our Russian larch offers a splendid material for plate-backing. It is lighter than teak, is not liable to the attack of worms, being of a

tarry nature does not rot, and is, generally speaking, stronger than the former. In the open air, and particularly in water, it becomes as hard as iron. With us in Russia larch is certain to supplant teak in the construction of ironclads, the foreign material being much more expensive, and in no way superior."

Colonel Okannieff, author of a work entitled "The Theory of Ironclad Shipbuilding," likewise testifies to the superiority of larch over teak for the backing of iron plates.

It should be remarked that up to within a few years ago the export of Russian larch was strictly forbidden. This dog-in-the-manger policy, however, was abandoned in 1860, when a company was formed by Mr. Latkin for the export of larch timber from the Petchora.

The oak grows in Russia in the provinces of Courland and Liefland, then takes a southerly direction to the governments of Witepsk and Smolensk, then makes a bend to the Volga. On the right bank of that river there are no good oak forests, but along the left bank they extend to the utmost limits of Southern Russia, extending also into the Crimea and throughout the Caucasian regions.

The common ash, as a small thin tree, is met with far in the extreme north, but as a fully developed tree it flourishes more to the south. The northern limit for its full development must be considered the governments of Liefland, Courland, Volhynia, Mohilew, Vladimir, and then a line along the right bank of the Volga. Under favourable conditions this tree reaches a height of 100 ft. with a diameter of from 3 to 4 ft.

The white maple is met with in the forests of the middle and southern provinces, but particularly in the governments of Podolia, Volhynia, and others adjacent to them; it grows likewise at the foot of the Caucasian Mountains in Georgia, and along the River Kour. It lives about 300 years, and generally it reaches a height of from 80 to 100 ft.

The lime, or "linden tree," is found in the whole of middle Russia, and flourishes mostly in damp soil, on the low spurs of mountains, and in the plains. It is very hardy and continues to grow even when its trunk is entirely rotten within. Under favourable conditions of growth it reaches a height of 80 ft., with a diameter of from 4 to 6 ft. The bast or inner bark of the lime tree is used for the manufacture of what are called "Russian mats," of which millions are made annually for home consumption and exportation, to the destruction of entire forests of lime trees. From the outer bark are manufactured the Capti or peasants' shoes.

The common birch extends far into the north and east of Russia.

In the northern "tundras," or extensive marshy plains, the birch

closes the limit of arboreal vegetation; and to the east it not only spreads over European Russia, but extends through Siberia as far as the sea coast of Kamtschatka. When young the birch tree grows very fast; afterwards its growth is slower, so that a full-grown tree of from 60 to 80 feet high is seldom more than 1 ft. in diameter, but trees are occasionally met with 2 ft. diameter. The Carelian and wavy birch are modifications of the common birch with knotty excrescences, and they grow principally in Finland.

The common walnut tree grows in the government of Kherson and the Crimea, and is very abundant in the Caucasus, where it often attains to a great age and size, and generally reaches a height of from 60 to 80 ft.

Beech is met with in Russia in large quantities only in the Crimea and the Caucasus, although it is also found in limited quantities in Poland, and other parts of mid and south Russia.

Boxwood grows to good size and quality, for wood engravers' blocks, in the Crimea and the Caucasus, and is largely exported for that purpose to other parts of Europe.

Although coal has been discovered, and is worked in some parts of Russia, its consumption is very limited, the yearly output for the whole of the empire not exceeding 1,190,000 tons, including brown coal, consequently the quantity of wood fuel, consisting of such valuable material as pine, fir, and birch, consumed by nearly all the railways, factories, and works of Russia, and used in private households, is enormous. Entire districts have been laid bare which were formerly dense forests, the finest trees being cut down in the most ruthless manner, without the least regard to economy or a rational mode of procedure, such as characterizes the forest culture of Germany. Then there are extensive districts denuded of forests by fires, which are of very frequent occurrence.

Throughout Russia these have caused in many localities a scarcity of wood, and consequently enormously high prices. The extent to which the destruction of forests is carried out in Russia, may be gathered from the fact that the Volga and Kama steamers alone consume something like 35,000 cubic fathoms (of 7 ft.) of wood yearly, which, together with the towns situated on the Volga, is estimated at 500,000 cubic fathoms, consisting principally of pine, fir, and birch. The small consumption of coal is attributable to the dearness of its carriage inland, but much of this is evidently due to mere routine or interested motives; and as an example of this the following case may be taken:—For some time anthracite has been conveyed over the Volga Don Railway and then down the Volga. Here the somewhat curious sight has been seen of a train laden with coal being drawn by an engine burning wood fuel!

Peter the Great evinced much interest in the propagation of trees of various kinds throughout his empire, although their destruction is the prevailing fashion at present.

The following characteristic autograph letter* of the Czar to Prince Galitsin will show his solicitude in these matters and his practical turn of mind:—"Mr. Colonel, We have written to the Duke (of Mecklenburg) by the present courier, in order that he may give you permission to dig up some young beech trees with the roots, near Rostock, or other locality in the vicinity of Rostock, to be sent to St. Petersburg, about which thou also must solicit him, so that you may have a space granted you at once; and when you have had a place allotted where to dig them, let young beech trees be dug up, which should be about 7 or 8 feet high, lopping off the tops, and in thickness according to the enclosed drawing, about six thousand of them; and, besides, order about 1,000 beech saplings to be dug up. For this purpose find a gardener of some sort for the time, who could show you how best to dig up these trees and lop off the tops. In the meantime endeavour, in order to transport these trees to St. Petersburg, to hire at Rostock a galleon or other large sea-going vessel that would hold these trees, and about the freight arrange with the captain to be paid at St. Petersburg, in merchandise of whatsover kind he may desire, with the exception only of two articles: leather and tar."

* This letter was discovered only a few years ago among the papers of the Galitsin family.

(*To be continued.*)

Protecting River Sides.

By D. SYM SCOTT, Forester, Ballinacourte, Tipperary.

Generally speaking, the forester who aspires to the position of estate manager, finds himself looked upon by his employer as a sort of semi-factotum, able to direct and execute on proper economic principles all the affairs of the landed estate. Therefore protecting banks of rivers from being washed away by flood is a subject, if not actually arboricultural, endowed with certain collateral ties which bring it within the acknowledged limits of consanguinity, and as there are few foresters but have to undertake operations of this nature at one time or another, our remarks are all the more appropriate. At the outset, before prescribing the cure it is necessary to understand the disease, or in other words to ascertain correctly the point from which danger is to be apprehended.

Rapid-running streams are frequently the cause of much land being destroyed. Flowing, as they do, with an impetus almost irresistible, they carry with them large quantities of shingle, which if deposited on meadows or low-lying fields, renders them permanently sterile. The principal causes of inundations are freshets and thunderstorms. Now the danger of streams bursting their banks is increased or decreased according to circumstances, such as loose open subsoil, obstructions, or quick bends. Water, having the power of efflux or reflux, occasionally cuts out new channels, thereby entirely changing the course of the stream. Low-lying holms or haughs are liable to be washed away through the want of a little attention being bestowed in time to the gradual encroachment of the water. When the force of the current is dashed against a sudden bend where the subsoil constitutes a gravelly bed, its action is to undermine the bank, when the surface having nothing to rest on naturally gives way, and in such large areas as to materially interfere with the size of the meadow. In this case a bulwark of stones and brushwood placed a little above the probable breach, in a position to divert the force of the current past it, will, if properly formed, operate with powerful effect. Stones and fagots dropped with no particular care into the river soon become consolidated with sand and gravel, making a simple yet substantial breakwater, which can be speedily erected in all shallow waters. In deep water—that is, four or more feet deep—the work of repairing banks

of rivers is more expensive. Thinnings of young spruce plantations, having the branches left on, may be placed perpendicularly and packed close together; the whole to be interwoven with large branches, until a complete mass of wicker-work is formed, to which may be added for stability a few long piles. This form of bulwark must be commenced at the side, and as tire upon tire is laid or intermixed with stones the whole mass gradually sinks to the bottom of the river, and when sufficiently well compressed to permit of carting, all material should be carted over the newly formed bank, so as to render the work more compact. When properly done this style of bulwark is capable of resisting the most strenuous efforts of the water.

If the bank is moderately high, and the soil of a strong adhesive quality, fagots of brushwood laid at right angles with the stream, or the ends slightly inclining downwards, are well adapted for resisting the force of the current. When a breach is actually made in the bank, nothing can equal tree roots as material for stopping or filling it. Built with ordinary care, the spurs get interlaced in a most formidable manner. From our own experience we can testify to their merit, and strongly recommend them to all having work of the kind to execute.

When danger is to be apprehended from rivers overflowing their banks, the sides should be sloped to a declivity of one foot in four from the surface to the bottom; then form a frame of rough timber to be laid on this slope, and carefully causeyed with stones, and afterwards covered with fine sand. The frame may be raised a few feet above adjoining field by being supported with a wall behind. Where fagots are scarce and stones plentiful, this sort of bulwark answers two purposes—it protects the bank and utilizes the stones, often an impediment to the plough. A frame of wood similarly constructed makes a capital protection for piers of bridges, and can be erected perpendicular or diagonal as deemed necessary.

If the soil and subsoil be clay or loam resting on gravel, the bank should be sloped as described; the declivity covered with strong sods of a rushy nature compressed with rammers, and done early in summer to give the sods time to unite with the solid ground. If this is attended to, the rushes will throw out all over the slope a mass of roots impervious to the water's encroaching proclivities.

The accumulation of gravel banks in the centre of the river requires only to be removed to give the current a clear run, and if attended to in time this obstruction can be removed with little expense.

As summer is the proper time for repairing river sides, willows can be planted on the banks the following autumn. The willow luxuriates in the immediate vicinity of water; it throws out thick matted roots

in abundance, which protect the bank, while the annual cuttings of the wood will in most instances be equal to the heritable value of the land they occupy.

Every admirer of the picturesque will admit with regret that trees which add so much to the adornment and embellishment of a district are injurious to the sides of streams. Trees are injurious generally, but some more so than others. Large trees are liable to be shaken, and at times blown down, which commences what ultimately proves a serious breach in the bank. In some parts of Ireland poplars are planted along sides of rivers for the double purpose of fencing and providing fuel. When large, the trees are decapitated and made pollards, a practice which answers the purpose with admirable effect.

There are many instances to be met with where much valuable land is lost through neglect, and landowners and tenants would not only be adding countless and varied charms to the landscape, but improving and enriching the district, were proper attention bestowed to the utilizing of river sides.

That river sides can be utilized to return a fair remunerative rent must be admitted as a fact if we calculate that 6,000 tons of willows are annually imported and sold in the English market at £5 10s. per ton. Surely British economy can compete with foreign industry, and the £33,000 worth of willows annually brought from Holland and France successfully cultivated at home. Willow is easily propagated, and requires little or no attention either in planting or after treatment. Black willow, or "sallow," forms an excellent hedge planted along the verge of rivers, and beyond the cost of planting is attended with no expense.

The Origin of Rafting Timber.

It is probable that the most ancient mode of constructing vessels for navigation gave rise to the first idea of conveying timber for building in the like manner; as the earliest ships or boats were nothing else than rafts, or a collection of beams and planks bound together, over which were placed deals. The above conjecture is confirmed by the oldest information to be found in history respecting the conveyance by water of timber for building. Solomon entered into a contract with Hiram, king of Tyre, by which the latter was to cause cedars for the use of the temple to be cut down on the western side of Mount Lebanon, above Tripoli, and to be floated to Jaffa. The words at least employed by the Hebrew historian, which occur nowhere else, are understood as alluding to the conveyance of timber in floats. At present no streams run from Lebanon to Jerusalem; and the Jordan, the only river in Palestine that could bear floats, is at a great distance from the cedar forest. The wood, therefore, must have been brought along the coast by sea to Jaffa. The Romans, says the learned Beckmann, transported by water both timber for building and firewood. When they became acquainted, during their war against the Germans, with the qualities of the common larch, they caused large quantities of it to be carried on the Po to Ravenna from the Alps, particularly the Rhœtian, and to be conveyed also to Rome for their most important buildings.

Vitruvius says that the timber was so heavy that, when alone, the water could not support it, and that it was necessary to carry it on ships or on rafts. Could it have been brought to Rome, he says, it might have been used with great advantage in building. This, however, was sometimes done, for Tiberius rebuilt a bridge with larch planks procured from Rhœtia, and among these was a trunk 120 feet in length, which excited the admiration of all Rome. That the Romans procured firewood from Africa, particularly for the use of the public baths, is proved by the privileges granted on that account to the masters of ships or rafts; but there is reason for believing that the Germans were the first who formed establishments for this mode of conveyance on a large scale.

The earliest information respecting the floating of wood in Saxony appears to be as old as the year 1258, when the Margrave remitted to

the monastery of Porta the duty collected at Camburgh from the wood transported on the River Saale for the use of the monastery. It is, however, uncertain whether wood really conveyed in floats, or transported on boats or lighters, be here meant; but in the year 1410 we find that a Rhenish florin was demanded for floats brought on that river to Jena, and two Rhenish stivers for those carried to Weissenfels; and in 1431 the floating of timber was undertaken by private persons, at their own risk and expense. When the town of Aschersleben built its church in 1495, the timber used for the work was transported on the Elba from Dresden to Acken, and thence on the Achese to the place of its destination. This is the oldest account known of floating timber on the Elbe. A float-master was appointed in 1564, who had to give security to the amount of 400 florins, so that the business of floating at that time must have been of considerable importance. Floating of wood was undertaken at Annaberg in 1564, by George Oeder, and at the expense of 4,000 florins; and in the sixteenth century the principle was in practice in Brandenburg, on the Elbe, Spree, and Havel, in Bavaria, and in the duchy of Brunswick.

As the city of Paris had consumed all the wood in its neighbourhood, and as the price of that article became enormous on account of the distance of forests and the expense of transporting it, John Rouvel, a citizen and merchant, in the year 1549 fell upon the plan of conducting wood bound together along rivers which were not navigable for large vessels. With this view he made choice of the forests in the woody districts of Morvant, and as several small streams and rivulets had their sources there, he endeavoured to convey into them as much water as possible. This great undertaking, at first laughed at, was completed by his successor, René Arnaul, in 1566. The wood was thrown into the water in single trunks, and suffered to be driven in that manner by the current to Crevant, a small town on the River Yonne, where each timber merchant drew out his own, which he had previously marked, and after it was dry formed it into floats that were transported from the Yonne to the Seine, and thence to the capital, and the system continues to this day. Victor Hugo gives the following animated account of floating rafts:—"The traveller who ascends the river sees it, so to speak, coming to him, and then the sight is full of charms. At each instant he meets something which passes him; at one time a vessel crowded with peasants, especially if it be Sunday; at another a steamboat; then a long two-masted vessel laden with merchandise, its pilot attentive and serious, its sailors busy, and with women sitting at the door of the cabin. Suddenly there is a winding in the river; and formerly, on turning, an immense raft, a floating house, presented itself, the oars

splashing on both sides. On the ponderous machine were cattle of all kinds, some bleating, some bellowing, when they perceived the heifers peaceably grazing on the banks. A whole village seemed to live on this float—on this prodigious construction of fir." So early as the time of Cardinal Richelieu the French began to bring from the Pyrenees timber for masts for their navy; but as the expense was very great, the attempt was abandoned, till it was resumed in the year 1758 by a private company, who entered into a contract with the minister for supplying the dockyards with masts. After 1765, Government took that business into their own hand; but it was attended with very great difficulties.

So soon as the floating of wood began to be a profitable undertaking in Germany, it was fixed upon for taxation. Hence, therefore, arose the float-regal, which, indeed, on account of the free use granted of rivers, the many regulations requisite, and its connection with the forest-regal, can be sufficiently justified; but when and how originated the term "*jus gratiæ*" has long puzzled the learned. In the German and kindred languages no derivation of it can be found. One conjecture is the following: the lakes and streams belonged to the Wassenaers, who kept swans, geese, and ducks upon them. When the brewers were desirous of clearing the water from the duckweed (which was used in making beer), which in Fritsch's German Dictionary is called *Enten-gratz*, in order that it might be fitter for use, they were obliged to pay a certain sum for permission; and when the practice of floating timber began, the floats disturbed the ducks, and destroyed the plant on which they fed, and the proprietors of floats were on this account obliged to pay a certain tax also.

Into the modern system of floating timber, as practised in America and Europe, it is not necessary to enter, the operations being so well known, our present object being to show how the practice originated, and with whom.

Whichwood Forest.

This is situated on the west side of Oxfordshire, between the rivers Evenlode and Wainrush, each of which runs within about a mile of this forest. At the early part of the present century it was almost entirely encompassed by a stone wall, not, however, wholly built on Crown lands, but comprehending various coppices and open wastes, belonging to private proprietors, and not included in the perambulation of the Stuarts' time. At the time above mentioned the lands in this forest belonging to the Crown amounted to 3,742 acres. The offices appointed for the government and care of the forest were those of a ranger, a lawnder (or keeper of the lawns), and four bailiffs or keepers, with two verderers and a woodward. The offices of the ranger, lawnder, and four bailiffs appear to have been granted at different times for different terms. In the 30th Elizabeth they were granted to John Fortescue, Esquire, and Francis his son, for their lives; and in the 40th of the same reign the same offices were granted to Henry, Lord Danvers, his heirs and assigns, so long as there should be any heirs (male) of Sir John Fortescue, Knight, surviving. In the 23rd James the First they were granted in fee to Henry, Earl of Danby; and lastly, in the 13th of Charles the Second, those offices having reverted to the Crown by the forfeiture of Sir John Danby, they were again granted in fee to Edward, Earl of Clarendon, his heirs and assigns, by the title of "The Office and the Officers of the Four Bailiffs in the Forest of Whichwood," &c., and this patent was purchased in the year 1751, from the descendants of the Earl of Clarendon, by the Duke of Marlborough. According to ancient grants the fees used to be as follows:—

	£	s.	d.
Four Bailiffs, at 4d. per day each	24	6	8
Rangership „ 6d. per day	9	2	6
Lawndership „ 6d. per day	9	2	6
	£42	11	8

—which sum was paid to the ranger out of the produce of the forest coppice from the 13th of James the First, and probably for a much longer time, and no other payment was made until the above date of

purchase by the Duke of Marlborough, when Lord Hyde, from whom it was purchased, preferred a memorial to the Treasury, claiming a still further sum of £21 5s. 10d., and this claim was made by virtue of the grant to Lord Clarendon in 1661. Perhaps the claim was just, and it would occupy too much space to enter into the merits of the question, but investigations into the history of English forests are sadly apt to shake one's faith. At any rate, the Lords of the Treasury gave directions for paying what should appear to be due to Lord Hyde, only Lord Hyde and the Duke of Marlborough appear by an inadvertence of the auditor to have received as follows, which was not owing :—

	£	s.	d.
Lord Hyde	1,916	5	0
Duke of Marlborough	862	6	3
	£2,778	11	3

It is said advisedly that perhaps the claim was just, for under the then slipshod system of dealing with English forests it may be quite possible that a far larger sum was owing by the Crown. But all these statistics have the demerit of sameness, and for that reason are curtailed. It is far more interesting to know that in the years 1778 and 1790 there were sent to Deptford Dockyard from this forest 105 loads and 34 feet of naval timber, the produce of which, at the customary rate of 38s. per load paid by the Navy Board for the King's timber, together with the lops, tops, and bark, amounted to £376 10s. 2d., and during the same period that scrubbed and unthrifty timber was sold for £233 13s. 2d., making a total (modest enough) of £610 3s. 4d.

There is no earlier survey of the forest than that of 1783, when in the coppices there were 8,390 trees, containing 945 loads, and in the open forest 18,232 trees, containing 1,677 loads. The next survey, in 1789 and 1790, distinguishes between the different kinds of trees, and is as follows :—

	In the Coppices.			*In the open Forest.*		
Oak.	*No.*	*Lds.*	*Feet.*	*No.*	*Lds.*	*Feet.*
Fit for the Navy ...	168	160	40	5	3	13
Improving, from 20 to 30 years' growth and up	5,441	—		5,774	1,235	1
Saplings under 20 years	2,710	—		6,880	414	44
Not improving	1,141	—		5,378	406	34
Firewood	69	—		37	14	45
	9,529	—		18,074	2,072	37

This statement is imperfect, as it does not supply the number of loads for the whole of the items in the coppices. Other trees may be briefly dismissed.

	No.	*Lds.*	*Feet.*
Ash.			
In the coppices	157	24	40
In the open forest	13,291	727	39
Elm.			
In the coppices	20	1	47
In the open forest	332	74	0
Beech.			
In the coppices	14	6	26
In the open forest	576	136	44
Sycamores.			
In the open forest	66	11	32
Limes.			
In the coppices	22	1	49
In the open forest	101	19	12
Horse-chestnuts.			
In the open forest	72	10	46

The Surveyor-General of the period states that there was no appearance of young oaks coming up in the open parts of the forest, nor that such a thing was possible unless a stop was put to cutting bushes and lopping young trees, which he plaintively remarks "is done in open day, and often carried away in the night." Swine and deer, he states, are not kept out of the king's coppices, as they "are out of private coppices where good timber is growing." In short, the worthy gentleman complains about everything and everybody, except the want of management on the part of himself and his superiors and subordinates. W. R.

Quercus Pedunculata—the British Oak.

THE oak tree has been specially venerated from the earliest ages. Under the Oak of Weeping, "*Allonabchuth*," Deborah was buried in the year B.C. 1732. Saul and Jonathan were also buried under an oak. Absalom's head was caught in the branches of an oak. Abimeleech was crowned under an oak at Shechem. Under an oak tree Jacob hid the idols of his wives. The Arabs still use the oak for the burial-place of their sheikhs. Large oaks have at all times been the favourite resort for the performance of religious rites. Coming to the oaks of the present age, we have the one from which glanced the arrow that killed William Rufus on the 2nd August, 1100, still lingering to the fore, and which must have been a tree of some size even then. The "Ball Oak," Wedgenock Park, the "Cowthorpe Oak," and the "Plester Oak," are supposed to be of nearly the same era as the Norman Conquest. The "Parliament Oak," in Clipstone Park, is supposed to be 1,500 years old. Its name arose from Edward I. holding his parliament under its branches. "The Duke's Walking-stick," at Welbeck Abbey, is 112 feet high, and the Greendale Oak covers a space of 700 square yards, with a coach road cut through it. "The Two Porters" are 100 feet high. "The Seven Sisters" have seven stems 90 feet in height. The largest oak in England is at Cowthorpe, Yorkshire. It measures 78 feet round where it meets the ground. In 1810 an oak was felled near Newport, Monmouthshire, measuring 28½ feet in circumference, and supposed to be 400 years old; the timber sold at £670, and its bark for £200. A very curious oak was found in a forest near Baden-Baden in 1818. It was formed of two distinct trunks, springing from one bole, and again uniting and forming a perfect tree. During the early ages, when the country was under the sway of the Druids, the oak was held in high veneration by the people. The mistletoe of the oak was called "All-heal," being considered a remedy for all diseases, and as such was much used in later times.

"A glorious tree is the old grey oak;
He has stood for a thousand years—
Stood and frowned on the wood around,
Like a king among his peers."

Jotting from Lou Fitt's Scrap-book.

Raising Trees from Leaves.

The first who made this art known was Agostino Mandirola, Doctor of Theology, an Italian minorite of the Franciscan order. In a small work upon gardening, printed for the first time at Vicenza, in duodecimo, in the year 1652, and which was reprinted afterwards in various places, he gave an account of his having produced trees from the leaves of the cedar and lemon, but he does not relate this circumstance as if he considered it to be a great discovery; on the contrary, he appears rather to think it a matter of very little importance. His book was soon translated into German, and his account copied by other writers, such as Böckler and Hohberg, who were at that time much read. A gardener of Augsburg, as we are told by Agricola, was the first who imitated this experiment, and proved the possibility of it to others. He is said to have tried it with good success in the garden of Count de Wratislau, Ambassador at Ratisbon from the Elector of Bohemia. But never was this experiment so often and so successfully repeated as in the garden of Baron de Munchausen, at Swobbler. A young tree was obtained there from a leaf of the *Limona rivo*, which produced fruit the second year. It was sent to Mr. Volkamer at Nuremberg, who caused a drawing to be made from it, which was afterwards engraved, in order that it might be published in the third volume of his Hesperides; but as the author died shortly afterwards it was not printed. The exact drawing as it was then executed at Nuremberg, and an account of the whole process employed in the experiment at Swobbler, were published by the Baron de Munchausen himself, from authentic papers in his grandfather's own handwriting. No one, however, attracted so much attention to this circumstance as the well-known George Andrew Agricola, physician at Ratisbon, who, with that confidence and prolixity which were peculiar to him, ventured to assert that trees could be propagated in the speediest manner by planting the leaves, after being steeped in a liquor he had invented; and for the truth of the assertion he referred to his own experience. Among the naturalists of that period, none took more trouble to examine the possibility of this effect than Thunning, who endeavoured to prove that not only leaves with eyes left in them, could in well-moistened earth throw out roots which would produce a stem, but that leaves also without eyes would grow up to be trees. Baron Munchausen, on the other hand, assures us that, according to the many experiments made in his garden, one can only expect young plants from the leaves of those trees which do not bring forth buds; that experiments made

with the leaves of the lemon tree had alone succeeded, but never those made with the leaves of the orange or lime tree; and that Agricola and Thunning had erroneously imagined that the leaves themselves shot up into trees, their mid rib becoming the stem, and the collateral ribs or veins the branches. It is probable that the well-known multiplication of the Indian fig gave the first idea of this experiment; for every joint of that plant stuck into the earth, and properly nurtured, throws out roots and grows. As these joints were commonly considered to be leaves, people tried whether other leaves would not grow in the same manner. Luckily those of the lemon tree were chosen for this purpose, and what was expected took place. Thus from a false hypothesis have new truths been often derived; and thus was Kepler, by a false and even improbable opinion, led to an assertion, afterwards confirmed, that the periodical revolutions of the planets were in proportion to their distance from the sun. But the raising of trees from leaves was too rashly declared to be a method that might be generally employed, for it is certain that it now seldom succeeds. W. R.

Prices of Timber in Kent.

The annual sale of oak timber, blackrinds, and oak-top fagots upon the Surrenden-Dering estate, in the parishes of Pluckley, Little Chart, Smarden, Westwell, and Bethersden, took place on the 26th ultimo, when about 180 lots were submitted to public competition by Messrs. Bayley and Son, of Ashford. The timber was not of the class usually offered on this estate, as most of the last winter's falls of underwood, from which the thinnings are made, were upon the inferior woods of the estate. The company was, however, a large one, and the sale correspondingly brisk. The oak timber ranged in price from 1s. 6d. to 2s. 8d. per foot; blackrinds from 2s. 6d. to 9s. each; and oak-top fagots from 25s. to 30s. per 100. The terms of payment in this locality are, for purchases of less than £5, prompt cash; £5 and upwards, half the purchase-money at the time of the sale, and the remainder early in October. The demand for timber of all kinds has been good throughout the season. Hop-poles have not, however, attained the prices of former years. Norwegian fir poles, so extensively used in the best hop plantations for lows, and for carrying the wire and string now employed in hop-growing, have commanded very high prices upon the Maidstone and Faversham wharves. Ordinary home-grown hop-poles have realized from 10s to 36s. per 100, according to length and quality of wood. Ash and sweet chestnut have been much sought after.

Pluckley, August 6th, 1877. A. J. B.

ENGLAND.

The trimming of all hedges round woods and plantations should now be finished without delay. Where such has not already been done, the tops and sides of hedges should be so cut back as to produce a wedge-shaped fence, — thin, and almost coming to a point at the top, and gradually widening to the base. The pruner need not be sparing in the use of his hook or shears, as few shrubs are more patient under their operations than the hawthorn and holly. Where the young quick does not thrive, a slight dressing of genuine bone superphosphate will push it forward rapidly. The sides of all wood rides and footpaths should be closely trimmed preparatory to the shooting season, and the margins of all open ditches well brushed before the fall of the leaf, while the bottoms of such ditches should be thoroughly scoured before the autumnal rains flood them. The scourings collected and mixed with lime will make a valuable compost for young trees. All young plantations of birch, &c., should be carefully dug and weeded, and open ditches cut where needed.

Finish transplanting all evergreen trees and shrubs as soon as possible, watering only in very dry weather. After watering, mulch around the stem. Take care to have the new hole ready before lifting the tree, and allow its roots to remain exposed as short a time as possible. Wherever proper appliances are at hand the large ball system is the best and surest mode of transplanting. If the cost of the operation be somewhat greater, its results are more certain. No fears need be entertained on account of the sizes of head or density of foliage, if the manipulation be dexterously and skilfully performed. *Austriaca, Pinus insignis, laricio,* &c., are easier of removal than the hard-wooded deodara. By no means attempt the removal of evergreens during the prevalence of a dry easterly wind.

Proceed with the pruning of deciduous trees, taking care to remove all epidermic branches. The positions of the overhanging branches,

now they are laden with their foliage, will, at this season of the year, be a better guide to the pruner than when such branches are bare and more erect in winter. For further details of the method of pruning the reader is referred to an article on the subject in the current number of this journal. September is decidedly the best month for pruning the majority of forest and ornamental trees. The walnut in particular should be pruned as early as possible in the month. The cuttings of yew of one or two years' growth, if cleared of all twigs and leaves upon their stems, and planted in a shady spot early in the month, are almost certain to take root.

Now is the time to look carefully through all new plantations, removing dead trees, and digging holes for their successors. Some clue to the causes of failure may now be obtained by carefully noticing the soil thrown out,—whether from excessive drought or moisture, from poverty of soil, or other causes. While the leaves still hang upon their congeners the position of all dead plants may be seen at a glance. An estimate of the planter's requirements for the coming season may now be made, and the extent of the probable drain upon the home nursery and the resources of the nurseryman be approximately arrived at. Attend well to stakes and supports of all kinds before the winds of the autumn cause irretrievable damage. The woodreeve should keep a good look-out in all recently thinned plan tations for young trees which from weakness of stem, or from the weight of foliage, have become bent. By a timely lightening of the head many such may be restored to their erect positions, if taken in hand before the return of the sap ; while such as are beyond recovery may at once be cut down. The coppice falls for the ensuing winter may now be fixed on, and arrangements made for an early canting ou or allotment of such falls.

All trenching for winter planting should be finished, so as to allow the early frosts to pulverize and prepare the soil. During the past season we have paid 1s. 6d. per rod for thoroughly trenching heavy clay for new plantations to the depth of eighteen inches ; and from 9d. to 1s. 3d. per rod run for cutting new ditches through birch plantations, such ditches varying from 2 ft. 6 in. in width and 2 ft. deep, to 3 ft. 6 in. in width and 3 ft. deep. Holing for small plants, two spit, or about 18 in. each way, and 10 in. deep, has cost from 9d. to 1s. 3d. per 100 holes, according to soil ; and larger holes for chestnut, oak, poplar, &c., up to 6s. per 100.

Composts should now be carted and deposited in convenient spots for future operations. Much less labour and considerably less damage to the land will result from an early attention to this. All fresh mould, road scrapings, ditch scourings, leaf mould, or peat are valuable adjuncts for this purpose. For clayey and marly soils in

particular these should invariably be mixed with lime, which comminutes and decomposes the clays and marls, and, by liberating their potash, renders it available as food for the young plants. Lime also removes all sourness from the soil. An analysis of the ashes of any particular wood will be the surest guide in the preparation of a compost for the trees. Thus the ashes of the oak show the presence of potash, silica, lime, soda, and several acids; and as lime contains both potash and phosphoric acid, it is invaluable in forming a compost for a plantation of young oak.

Proceed with the cartage of draining pipes, road material, fencing posts, &c., likely to be required during the winter, and remove all timber from the sides of roads.

Where young and unfenced plantations are exposed to the depredations of hares and rabbits, it will again be necessary to wash those parts of the stems and branches within their reach. This should be done in dry weather, so as to allow the wash to adhere firmly to the bark. A mixture of Stockholm tar, night soil, and lime, generally proves efficacious. When well stirred together, apply as thickly as practicable with a brush.

All ornamental trees, whether in wood-rides or other plantations, should have a space cleared round them to allow of a proper development of head. In pleasure-grounds and parks, where cattle and deer are grazed, the broken and browsed ends of branches should be cut off clean, and the main branches further lightened where necessary. At this season of the year it is no unusual occurrence for heavily laden branches of elm to break off: the stumps should have immediate attention. Further injury to beech and other fruit-bearing trees may be prevented by a timely pruning, where, as is the case during the present season, their branches are bent low and in many cases broken by the weight of their produce.

The forester who has an eye to natural effect will now have an opportunity of watching the autumnal changes in foliage; from the time when the hazy cloud-like outline of the maple passes from green to yellow, then to a golden tinge, and finally to a deep russet, down to the period when the dark tan colour of the oak leaves indicates their early fall. By observing carefully the effects of autumnal tints he may learn many useful lessons in grouping forest trees. As autumn approaches, the light green of the willow, flecked with hoar as the wind tosses its branches, and the still brighter green of the wide-spreading plane tree, form a beautiful foreground to the dense and well-defined rolling masses of sycamore leaves, the deepening shades of the oak, the elm, the silver and Scotch firs, and the coppery-tinged and gracefully waving plumes of the beech; while upon the nearest oaks patches of a brighter green, like shreds of

scattered sunshine, show where the new flow of sap in July gave a fresh start to portions of the foliage. Southey says,—

> "For o'er the leaves, before they fall,
> Such hues hath nature thrown,
> That the woods wear in sunless days
> A sunshine of their own."

Pluckley, Kent. ALFRED J. BURROWS.

SCOTLAND.

THE month of August, 1877, will be long remembered in Scotland, on account of the almost unprecedented rainfall experienced over the greater part of the country. Bridges have been swept away, houses have been inundated, and many fields of promising grain have been damaged to an almost incalculable extent. We are also sorry to hear that in some quarters a considerable portion of the bark harvest has been overtaken by these rains, and, as a consequence, has been rendered almost useless, especially where it has been set up to dry too near the ground. It is to be hoped that the last month's experience will have led landed proprietors to see what an immense boon it would be to their foresters to have sheds where the oak bark could be safely dried. At present a great many foresters have to hurry off their bark to the tanner as quickly as possible for fear of the rain, and it is thereby quite evident they are not in a position to stand up for a good price, as they must either take what is offered or else run the risk of having their bark spoiled by wet weather. If this rain had unfortunately fallen a few weeks earlier, as it quite possibly might have done, it would have entailed a loss of a hundred pounds or more to all those who engage to any extent in oak peeling. Well, a good deal less than that sum would erect a very substantial shed, which, with a little attention, would last for many years, where the bark could be dried even in the most unfavourable weather. Foresters would also be enabled to make sure that they got good value for their bark, instead of disposing of it in the haphazard way that many have to do at present.

In connection with these rains it is of the utmost importance to inspect and repair where found necessary the sides of open ditches running through plantations, as the great force of water will be found to have damaged them to a considerable extent. Many closed drains will also be found to have burst; these must also be looked to, and put right at once.

As the ground is completely saturated with moisture just now, the planting of evergreen shrubs, conifers, &c., can be carried on with

great advantage, as the plants will be able under such favourable conditions to establish themselves before winter.

Before the month is over we trust the harvest will be pretty general throughout the country, and no time should be lost when the fields are cleared to get the thorn hedges cut, as the workmen get better footing on the stubble, and the thorns are raked and burned with far more ease than when the fields are ploughed.

We would also, with the editor's permission, put down as one of the items of work for the month, a little duty which we hope some contributor qualified to do so will kindly take up, namely, to let our readers know the best design for a shed or sheds in which to dry oak bark; also the best method of protecting the sides of open water-courses from falling in, more especially with the view of saving them from the destructive effects of such heavy currents as we have experienced during the last month.

Dalkeith Park, N.B. R. BAXTER.

IRELAND.

THINNING overcrowded plantations should now be prosecuted with vigour. This is an excellent time to have auctions of material suitable for fencing, roofing, and other country purposes. Farmers are all requiring more or less timber of various scantling at this season, while wheelwrights and country joiners are particularly anxious for hardwood felled during autumn.

Switch hedges. Plashing quick fences may be commenced towards the end of the month.

Transplant spruce, silver fir, and other evergreen trees, in belts and screens infested with rabbits. Autumn is a very good time for removing large trees, as the sap contained in the tree descends and forms a callus at the extremity of lacerated roots, which throws out in a very short time an abundance of fibry roots.

General planting should not be commenced until the very end of the month, and even then only when the new wood on young plants is fully ripe. According to an old belief, forest trees may be planted in any month having an "r," but the season and the ground should regulate planting operations. Where the ground is hard and dry, with a southern aspect, it should be planted early in autumn; but when a cold, damp, northern aspect, it should be operated on in spring, and the same remark is applicable to ground overrun with rabbits, &c.

In the nursery, cuttings of every kind should now be planted, also stocks for grafting or budding on next season.

On the farm, prune all hedgerow trees immediately the crops are removed. We prefer autumn to summer pruning, as the process of cicatrization is more perfect.

Ballinacourte, Tipperary. D. SYM SCOTT.

WALES.

CONTINUE enclosing, clearing, and preparing ground for planting as last month. Where new fencing is necessary throughout in high-lying ground we adopt wire fences, erected with seven wires, stapled to wooden posts five feet apart, with iron terminal and training posts. Where the ground is favourable, thorn, or a mixed thorn and beech hedge may be planted within the wire fence, and, if not already done, the bed should be prepared for receiving the plants by trenching, &c.

The clearing of whins, brambles, and other brush, is generally done with strong short whin scythes or hooks, and then burned on the ground. Draining should be proceeded with; the depth of drains and distance apart to be ascertained, according to the nature and wetness of the ground, but eight to ten yards apart will be an average distance for open drains two to two and a half feet deep, and three and a half feet wide at top.

Continue the switching of hedges, and pruning of forest trees.

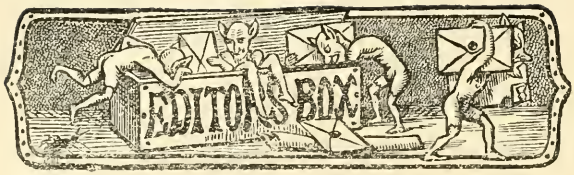
Remove and transplant evergreens with good balls, and water freely. The ground in which they are to be transplanted should be well prepared by trenching, &c., and improved by adding a quantity of decayed turf and leaf mould, which promotes the growth of new roots; and the plants should be kept rather above the natural surface of the ground.

Kinmel Park. LEWIS BAYNE.

The Omnivorous Caterpillar.

ALL owners of trees should take advantage of the present season to apply the prevention or means of destruction of the caterpillar, recently so successfully introduced in European parks. The plan is simple, and unattended with peril to the tree. Bore a small gimlet hole into the trunk of the tree, about a yard from the ground, penetrating at the depth of one-third the diameter. Fill this hole with the flour of sulphur, and then plug the aperture with wood. The rising sap will carry the sulphureous impregnation to the furthest extremity of every twig and leaf, and no caterpillar, even of the most infernal origin, can exist upon the tree.—*American Paper.*

[Whether the above is much known in England, or whether the writer merely assumes that it is a European custom in order to give force to his assertion of the efficacy of his nostrum, we are not aware. Certainly, if the caterpillar tribe can be thus easily banished from trees, the fact cannot be too widely known.—ED. *J. F.*].



PRESERVING OF WOOD POSTS.

Sir,—In your last issue there is a communication from Mr. Baxter on the "Preserving of Wood Posts;" and he gives, as a means of assisting in solving the question, a system he adopted with a fence the posts of which had rotted through at the surface of the ground.

It is impossible to form an idea as to the efficacy of his plan, as neither the size nor form of prongs is given; but if strong, substantial material were used in their construction, I would not doubt their adaptation for such a purpose, but fear it would come to be very expensive if the plan were generally adopted, even if efficient prongs could be got for the price quoted by him, viz., 6¾d.

The question, however, is the desirability of adopting some plan with posts that are to be inserted in the ground, so that it may act as a preventive of decay where they are most liable to be affected. An excellent method for that purpose is to encase the part of the posts at the surface of the ground with sheet lead or zinc. It could be done at very little expense; and if the operation were carried out as follows, their lengthened durability would amply repay all outlay.

The posts to be used should be carefully stripped of any bark that may be upon them, and properly seasoned, a piece of zinc for each post must be cut 18 inches long, the breadth to be regulated according to their circumference, and 2 inches extra allowed for overlap. Apply a layer of white-lead, about 1-16th of an inch in thickness, 9 inches above and below the ground level of the posts fix the zinc on the same with half-inch scrupper nails, making it fit tightly round and overlap the joint (which must also be covered with white-lead) 2 inches, closely nailing the whole to the post. The lead that may have been squeezed out at the ends must be taken off, and the ends and joints smoothed carefully over, care being taken that no opening is left for water to get betwixt the wood and zinc.

The above will only answer for posts that are to be sunk into the ground with the spade, as the casing would get displaced if they were driven.

Andrew Slater, Jun.,
Forester.

Wyreside Cottage, Lancaster,
14th Aug., 1877.

SIR,—I have read with much interest Mr. Baxter's remarks at page 275 on "Preserving Wood Posts," which no doubt is a subject of great interest to every one connected with fencing and its repairs. The great number of fence-posts required annually in keeping fences in a proper or needful state of repair is a considerable tax on the plantations of every estate; but the time these require to fix, and the injury caused to both wire and rail fences by their continual decay, is, to say the least, very annoying to every one entrusted with the oversight of such matters. Although glad to see any experiments recorded in your columns which result in any saving of labour or material, I am somewhat sceptical as to the one recommended by Mr. Baxter. In iron fences it is a difficult matter to fix with sufficient firmness the posts or "iron prongs" in the ground.

A wooden fence is more liable to pressure from wind, stock, &c., than iron, and therefore would be less likely to keep an upright position when fixed on a small iron prong. There is another objection to this plan: wood is more liable to decay where it comes in contact with iron, as shown, with nails, staples, &c.

As for the beech stob, I would as soon think of putting a Scots fir handle into my axe.

M. R.

SCIENCE APPLIED TO THE CULTIVATION OF LAND—"TONITE."

SIR,—As you have been kind enough to notice and insert a report of some experiments given by me at the special request of a number of practical gentlemen, a short time ago, near Leeds, I think a few words on the power and usefulness of "tonite" may be of use and interest to the readers of your Journal.

"Tonite," although largely used in mines, quarries, and shaft sinking, has not yet been fairly introduced to those interested in reclaiming land, for which it is specially adapted. The experiments reported on page 229 of your August number so thoroughly satisfied the gentlemen who witnessed them, that they pronounced it the safest and best explosive known for clearing land of tree stumps and boulder stones. The severe tests it was applied to prove its safety in use, transit, and storage, beyond doubt the very thing required to place in the hands of workmen, for with a little care and a few minutes' instruction any common labourer can use it with safety and expedition in the clearing of land.

Many acres are lying waste which could easily be cleared and converted into valuable land, as tonite has the singular property of striking downwards; so that by placing, say, a three-ounce cartridge on a stone weighing two to three hundredweight, and putting a little clay on the top of it, it will break the stone; or by placing another heavy stone on top of the cartridge it will break them both.

Heavy stones sunk in the ground can be removed by making a hole

beneath and placing a few cartridges in the hole thus made. A cheaper mode of removing boulder stones is by making a hole, say seven inches deep, in a stone weighing a ton or two, putting a two-ounce cartridge of tonite in, and pressing the earth in and covering it up with a shovelful of clay, when it will split the stone, so that it may be removed by a couple of labourers.

Tree stumps may be removed either by boring holes with an auger and putting a cartridge into each, or by making a hole under the roots and placing a few cartridges in it.

The stump will thus be burst up or riven, so as to be easily cut or dug out and cleared away. When more than one hole is bored in a heavy stump, and many to get out of the way of danger, I would recommend firing by electricity, as the whole will go off at once, and materially assist each other, for large stumps will require a charge in several places to burst them up effectually.

Tonite is six times the strength of ordinary blasting powder, and has a peculiar downward tendency, which is of much advantage in the operations of clearing land. The price is 2s. per lb., which, on taking the strength and efficiency of tonite into account, is much cheaper than blasting powder, as smaller charges are required; and as it will go off under water, much time and labour is thus saved, besides being the safest explosive known.

I shall be happy to communicate with any gentleman requiring further information on the subject. T. Dineen.

17, *Queen Street, Leeds, August* 15*th*, 1877.

THE CULLEN PRICES.

Sir,—I will now fulfil my promise of last month (see page 276) regarding my remarks on the "Cullen Prices" at page 114, signed "Ancora Imparo," and Mr. Michie's unsatisfactory explanation of them at page 195. In a few preliminary remarks I will state how my attention was drawn to the prices quoted from Cullen at page 31, and then proceed to give my authorities for challenging their correctness, and also give the average prices obtained in and around this neighbourhood.

Upon the issue of the first number of the *Journal of Forestry* I was, as may be easily imagined, eager to peruse its contents, and amongst other valuable and interesting matter I closely scanned the "Table of prices of Forest Produce in Great Britain," and naturally enough felt surprised at the high prices said to be realized in this county. Soon after this I had occasion to attend a meeting of several wood merchants and foresters, when the recent appearance of our new *Journal of Forestry* was mentioned, and after some conversation the subject of the high prices quoted from Cullen was brought up and discussed, with the result that no one present would believe that such extraordinary prices could be got in this district, at Banff or Cullen, either by private sale or at public

auction. I was then requested by those present to write to the *Journal of Forestry*, and state in as plain terms as possible that *no such prices* were in existence in the timber trade in the north of Scotland, with authority to use the names of the parties, if necessary, in confirmation of the fact.

In turning up the prices I quoted at page 116, I may say that the same prices are now difficult to command, as Scots fir of the best quality is being delivered from this estate in Aberdeen at 1s. 1d. per foot. As good but no better timber can be got, some of the trees measuring from sixty feet to eighty feet in length, and of large girth. The same timber was lately advertised in the *Timber Trades Journal*, and no one made an offer for it, showing the stagnation of trade and lower tendency of prices.

Without farther remark I shall now give the names and addresses of the parties who will corroborate my statements, if any of your readers desire to communicate with them in reference to the same; viz., Messrs. Lyon and Murison, timber merchants, Fyvie; Mr. Dallas, timber merchant, Macduff; and Mr. James McKenzie, Keilhill Saw-mills, King Edward. These parties devote their special attention to the purchase and disposal of home-grown timber, and although they send it to all parts of the country, wherever they can find a profitable market, they distinctly affirm that they cannot command anything like the Cullen prices.

I shall next mention one or two consumers of timber, viz., Mr. Duncan, boatbuilder, Macduff; Messrs. Watson, shipbuilders, Banff; and Mr. Andrew, mechanic, Danshillock, King Edward; and if need be others can be named in the near neighbourhood of Cullen. These parties say that they do not give more than the prices I have stated at page 116, as they can get "any amount of timber delivered free in their yards at those same prices or less." Mr. Andrew appropriately remarking that "the market price of our goods will not permit us to give more."

Mr. Terras, forester, Delgaty Castle, Turriff, says, "I cannot get anything like the Cullen prices, but I should be only too glad to get them if they exist; however, their existence is very doubtful." In a recent letter from Mr. Walker, forester, Balgonie, Fifeshire, he observes, "I see the forester would like to maintain his big prices at Cullen, but we certainly cannot get anything approaching his figures in this county." I will not farther enlarge on the subject, but merely add that during a fortnight's trip to the south I visited many foresters, wood merchants, shipbuilders, and others, with whom naturally timber and its prices was an interesting topic of conversation; but when I mentioned the wonderful "Cullen Prices," they were simply laughed at as being too ridiculous for a moment's consideration. On my own part I fail to comprehend how people can afford to pay such prices at Cullen, when they have to compete with the same commodities in the same market with those who are buying at a much cheaper rate the material consumed in the manufacture of precisely the same articles.

From a considerable experience of Glasgow prices, I should say that "Ranger" (see page 196) would command about the best prices to be got in Scotland; yet he there states he cannot get for oak within 1s. 6d. per

foot of the Cullen prices. Indeed, the very idea of this northern one-sided county commanding so much higher prices for timber than any other in Great Britain looks uncommonly open to doubt; and if they could only be realized, an average crop of timber at such paying figures would completely put in the shade all the calculations of Brown and others as to the great profits to be made from well-managed, or I should say *well-sold*, plantations. With these remarks I close the subject, and leave your readers to judge of their pertinence and correctness.

Duff House, Banff, N.B.
13*th August*, 1877.

J. B. Smyth,
Forester.

BLACK GAME.

Sir,—In the last number of your Journal, at page 274, I noticed an article entitled "Black Game," in which Mr. Robert More calls attention to the destruction of young Scots fir plants by Black Game.

There are few proprietors or their foresters who have had any considerable experience in planting on moorish, high-lying, or hilly situations, where black game abound, who have not experienced much annoyance and loss by their ravages.

Hares and rabbits you can extirpate, or protect your young plantations against them by wire netting, or by applying annually some of those protective compositions such as Davidson's of Leith; but how you are to cope with birds is another and more difficult question.

Foresters must never speak of injuring, far less extirpating, Black Game. Many proprietors would not think twice of planting Scots fir &c., for the express purpose of affording food for them.

A number of years ago, when the writer was engaged on one of the largest estates in Scotland, where a a large breadth of upland moor was annually planted with Scots fir, &c., an old man was kept for a few months in winter and early spring moving about among the plants all day with a hand-rattle whose skirr-rir for a time kept them at a distance, but even this proved ineffectual to scare them, as in course of time they got so well accustomed to the rattle that they would sit on the top of a tree with the utmost *nonchalance*, while the old man plied the rattle vigorously at the bottom.

I know an extensive proprietor, who is a most successful planter on low ground where game are very plentiful, but whose success is to a great extent attributable to wire netting, with which he encloses every inch of ground before putting in a plant. A great deal of money has been expended in netting, but when the plants are from seven to eight years old, and out of the reach of vermin, the wire netting is removed, and a fresh piece of ground enclosed, and he is now in a position to plant from 60,000 to 70,000 forest plants annually, and requires to purchase very little extra netting. Last year the same proprietor, having a considerable extent of hill ground to plant where black game are plentiful, had the ground

carefully fenced against sheep, &c., with a strong wire fence, and against hares and rabbits with wire netting, but having little experience of the ravages of black game, imagine then his surprise and dismay, after having in the autumn planted fully fifteen acres with larch, Scots fir, black Austrian and Corsican pines, to find about Christmas the most of the young trees stripped of their buds!

The most of these plants have, however, pushed young side shoots, and being late in starting have escaped a fresh mutilation in spring. As an experiment, all the buds of those planted this spring were smeared with Davidson's composition, two boys were employed, who took the plants out of the sheugh, applied a little of the composition with the forefinger, and laid them aside for the planters. This, however, did not prove quite a protective, as the birds would persist in picking off a few of the buds, but, not appearing to relish the taste, they invariably dropped them on the ground, and usually allowed the majority of the buds to remain. No birds appeared to be poisoned, the keepers reporting that they had not seen any dead.

Another, and in my opinion a much more effectual plan in guarding against the destruction of pines by black game, is to put in plants above their reach; those who have adopted this plan find it to be so. Good, hardy, well-grown three-year, one-year plants ought to be above their reach, are at the same time rather slim for them to perch on, if transplanted in the nursery the spring previously to being planted out will lift with good fibry roots, and if pitted and planted carefully will seldom fail; in fact, I have found them do better than two-year, one-year, even in exposed places, where, though apt to be blown and loosened at the roots by wind, a little attention will keep them all right.

In the beginning of April, when the heather is beginning to sprout, our friends (?) usually leave off and betake themselves "to fresh fields and pastures new," and do no more injury till the beginning of December—sometimes earlier, but by Christmas they are again busy attending to the pine trees.

I am sorry I am not in a position to give Mr. More any further information on this subject, but I am confident some of your more experienced correspondents will be able to offer us some more valuable advice upon the best methods of protecting pines from the ravages of Black Game.

A READER.

SPRUCE TIMBER.

SIR,—I am very glad to find that Mr. Wilkie has opened up another aspect in the discussion on the merits of spruce timber. I am afraid however, that the conclusion which he has arrived at will not commend itself to foresters in general. In his letter he asserts that the thorough seasoning and subsequent ventilation of this wood does more to preserve it

than any advantage it may have gained from either soil or situation. No one will deny that both of these processes are essentially necessary to give any sort of wood a fair chance of resisting decay; but it surely is no less true that such powerful agencies as climate and soil affect to a far greater extent the quality of forest timber. Moreover, if the spruce on this estate, through a long course of years and in a great variety of ways, has proved itself deficient in lasting qualities, no amount of seasoning can be expected to save it from premature decay.

Mr. Wilkie says he has seen railing cut from young spruce last for thirty-one years. Well, that is something very remarkable; but does he not see that the whole force of his argument is lost when he tells us immediately afterwards that it was "frequently coated with coal tar well boiled," because at present we are discussing the merits of spruce timber pure and simple, independent altogether of tar or any other preservative; and if these rails required such treatment in order to prolong their existence for thirty-one years, it might be curious to inquire how long they would have lasted without it. We must not fall into the error, however, of supposing that a rail standing out exposed to all weathers can last as long as a board of the same material kept dry, under a well-ventilated roof. Unless we observe this distinction it will be impossible to come to a safe conclusion on the subject. The suggestion about inserting a thin strip of hard wood between the paling rail and the stob, as a means of preventing rot at the junction, must be received with caution, because, wherever double nailing is required the hard wood is almost certain to split, even although the trouble is taken to bore it; and where it can be used with effect with one nail the result will be but a somewhat rickety structure after all, as the rails cannot be so well steadied, resting as they do on a five eighth surface instead of one three inches thick or more.

The last paragraph of Mr. Wilkie's letter deserves careful attention, as the subject of stob-preserving is to foresters one of the foremost questions of the day, and he will confer a benefit on many of your readers if he will mention the kind of wood the stobs were made of to which he refers, also if he can certify that they stood for the thirty-one years without ever needing to be renewed, because it does not matter how long a fence may have stood in any locality unless we know definitely whether or not it has undergone any repairs and their extent during that time.

Dalkeith Park, August 18th. R. Baxter.

PRICES OF SAWING.

Sir,—Please allow me to correct an error in the "Prices of Sawing," as given by me in your last number; viz., Scantling, Joists, Beams, &c., should be per 1,000 feet lineal, and not per 100 feet.

Boards, Planks, and Deals, and also Larch, Scots Fir, and Spruce Staves should be per 1,000 feet superficial, and not per 100 feet as stated.

D. F. McKenzie,

Meldrum House. *Forester, &c.*

AGE OF TREES.

Sir,—Some of your correspondents write about trees 100 years old, and seem to think this no great age. After all, I don't see that this has much to do with either the science or practice of forestry, or that it is suggestive of anything in particular, if it may not be turned to account as subject-matter for a Scotch sermon.

The following questions may, I think, be considered with advantage in the pages of your journal, viz., what are the kinds and varieties of trees which our climate will produce in greatest perfection? what are the particular purposes for which the same are most suitable? and what may be the probable return per acre, at the least possible outlay in time and labour? In short, what are the inducements to plant in this country at the present day? In any calculation on either of these questions it is needless, I think, to take land rent into account, as I am fully persuaded that 1,000 or 2,000 acres of our exposed uplands, taken in block, judiciously divided, and planted to the extent of one-fifth, or say one-tenth of the whole, according to situation and other circumstances, would within a very few years come to maintain the same amount of stock as before, if not in number at least in value; and there are other substantial advantages to follow that would go far to recoup the morsel of rent which it is now yielding, and with compound interest added.

It would be interesting to your readers to know something of the extent and value of the article "pitwood," which is annually imported into this country from abroad. My own knowledge of this and some other similar matters is limited, and I suspect that the same plea of ignorance must be put forth on behalf of many who are vastly more concerned than I am. This much we know, that pitwood alone forms a very considerable item in the traffic receipts of our railways, that it can be grown in this country to perfection, and to any extent required, and easily accessible to the pit head all over the country, on which and other advantages, public and private, I must leave some others to enlighten us. Referring to the Board of Trade returns of late, and comparing the enormous amount of our imports in excess of the exports, any one will see that the question is of some importance, and I hope it will be thoroughly ventilated in the pages of this journal. Jno. Dykes.

Wards, Kilmarnock, N.B., 22nd August, 1877.

Notes and Queries.

[Under this heading we propose to insert short questions and answers on all topics connected with Forestry, &c. We shall be glad of the co-operation of our readers in answering questions, as it is believed that by this means much useful knowledge may be diffused.—Ed. *J. F.*]

Cones on Wellingtonia Gigantea.—There are cones on a tree of the *Wellingtonia gigantea* here this season. Is this anything new?—N. Craig, *Arrowe Park Estate Office, Birkenhead.*

No, but still not common.—Ed. *J. F.*

H.M.S. "Caledonia," &c.—Has either H.M.S. *Caledonia, Tenedos,* or *Spartan* been opened for repairs since 1875, the date of publication of Laslett's "Timber and Timber Trees;" and if so, what evidence have they afforded as to M. de Lapparent's carbonizing process?—*G. S. B.*

Clearing Plantation Ground.—Would any of your readers kindly inform me what is the best and cheapest method of converting old plantation ground into arable land? What would be the cost per *root* (or stump) of using one or other of the following explosives?—Dynamite, Tonite, or Gunpowder? What should be the cost per square yard for trenching nine inches deep and removing all roots, there being few stones in the ground? The roots are all Scots fir; the trees were sixty years old, and cut down eight years ago.—*M. R.*

Luminous Wood.—I should be glad if any of your correspondents could give me some information concerning what is here called luminous wood,—the cause of its appearance, and whether some species of trees are more addicted to it than others. The other day, on uprooting the stump of a spruce fir that had been cut down some years ago, parts of it presented quite a phosphorescent appearance in the dark, so much so that one could almost read a book by the clear bright light given off by the phosphoric wood. An Irish workman tells me it is a common occurrence in some parts of Ireland.—F. Herbert, *Clytha, Monmouthshire.*

Culture of Eucalyptus in Algeria.

By CONSUL-GENERAL PLAYFAIR.

In the report of a journey I made to Tunis last year I stated my conviction, and I endeavoured to prove, that the principal cause of the decadence of that country, and of the exhaustion of its soil, was the destruction of its forests, which has been going on ever since the Arab conquest, and more especially during the past hundred years. Since then I have given much consideration to the question of the *reboisement* of Algeria, especially as to whether this process, so conducive to the public good, could not be made one of advantage to the individual speculator. When duty and profit can be made coincident it is wonderful how easy the former becomes.

For this purpose I determined to visit leisurely the whole of the plains of the Metidja and the Chelif, in which, if anywhere, suitable land might be found. I have read everything that has been written on the subject of Australian trees, and I purpose now to record, not only the result of my own observations, but the opinions of those far better qualified than I am as to the best means of restoring to Algeria the forests which were formerly the cause of its great agricultural wealth, and of opening out a means of employment for superfluous capital and energy.

The most interesting papers which have been written on the subject, and to which I more particularly allude, are—

1. Rôle de l'Eucalyptus en Algérie, par M. Trottier, 1876; and
2. L'Eucalyptus au Point de Vue de l'Hygiène en Algérie, par le Dr. E. L. Bertherand, 1876.

Effects of the Destruction of Forests on the Climate of Algeria.—The same causes which have been at work in Tunis have produced similar results though in a less degree in Algeria. In the latter country the destruction of the forests has been less complete, therefore the country has remained more fertile, but the climate is changing in an appreciable degree every year.

Tolerably correct meteorological observations exist in Algiers since 1838. If we divide this lapse of time into three periods, we find the annual rainfall as follows:*—

	Millimetres.
1st period of 12 years	800
2nd ,, ,, ,,	770
3rd ,, 14 ,,	639

There can be no doubt as to the cause of this decrease. At the period

* I need hardly apologize for using the French metric system, which is so much more rational than the English one. The reader need only recollect that a hectare is equal to 2½ acres, a pound to 25 francs, and a metre to 3⅜ feet.

of the conquest the whole of the Sahel and a great part of the Metidja was covered with wood or scrub, which acted not only as a parasol to the earth, preventing the undue evaporation of its dampness, but as a means of attracting and condensing the moisture in the atmosphere, and causing it to descend in refreshing dews or rain.

The first serious clearings in this district were made in 1845, since which time the operation has been going on with ever-increasing rapidity. The diminution in the rainfall commenced in 1855. In the seventeen years prior to this date it was only on two occasions more than 1,000 millimetres, and on eight occasions more than 800. In the twenty-one years which follow, it has only twice reached 800 millimetres, and the present year is almost worst of all, and something very like famine is imminent in Western Algeria.

Reboisement of Algeria by Australian Trees.—The question not only of restoring to the country the wood that it has lost, but of providing a supply of a constantly decreasing article, is the most important one that can engage the attention of the statesman or the colonist. If this had to be effected by planting such trees as oak, ash, pine, &c., all of which are indigenous to the country, it may well be imagined that a speculator would hesitate about engaging his capital in an enterprise which could hardly yield him a return in his lifetime; but with Australian trees, which grow as freely in Algeria as in their native country, he may expect to cover his expenses in ten or twelve years, and after twenty or twenty-five, to obtain as great results as could be realized by oak forests of a century's growth.

It is hardly more than fifteen years since the first Eucalyptus trees were introduced into Algeria by M. Ramel, and very few indeed exist in the colony of a greater age than ten years: even now it can hardly be said that any attempt has been made to grow them on a great scale.

In the following remarks I intend to confine myself exclusively to the Eucalyptus. There are many other Australian trees suited to almost every condition of soil found in this colony, such as the beautiful acacias or wattles, the Grevilii a, casuarinas, &c.; these are no doubt destined to play an important part in the *reboisement* of the country, but it is the Eucalyptus alone which merits to be planted over extensive areas for the sake of its timber.

There may be parts of Europe where this tree could be cultivated as well as in Algeria, though that is very doubtful, but hardly anywhere is the price of land sufficiently moderate to enable it to be grown with a certainty of profit.

As a rule, wherever the orange tree flourishes, so does the Eucalyptus. In Algeria it attains in six or seven years the same dimensions as the oak does in twenty, and in its twentieth year it may be expected to furnish such logs of timber for shipbuilding or other purposes as could not be furnished by an oak tree under 100 years old.

Quality and Density of Eucalyptus Timber.—There are trees which even in Europe, under certain circumstances, grow with great rapidity, but the

marvel is that, growing with the rapidity it does, the Eucalyptus should produce at the same time hard and dense timber. A short time ago, wishing to send a Eucalyptus tree of four or five years of age to England for experiment, it was found impossible, on account of its great length, to put it into a boat to convey it to the steamer. The boatman naturally decided on towing it alongside, but the moment he put it into the sea it sank to the bottom, and divers had to be employed to raise it. When properly seasoned its specific gravity becomes less, and it then floats on water.

To illustrate the quality of the timber, I may instance the case of a vessel, the *Marie*, of 230 tons burden, which entered the port of Algiers with a cargo of timber in 1875. It was built in Melbourne in 1848, the hull being of blue gum (*Eucalyptus globulus*), and the interior fittings of red gum (*Eucalyptus resinfera*). At twenty-seven years of age it was still rated by the *Bureau Veritas* as of the first class.

Rate of Growth.—The first trees ever planted in Algeria were sown in 1862. The following table shows the dimension of these and of others planted subsequently, taken in September, 1874, by M. Trottier:—

Year in which planted.	Age of Trees in 1874.	Circumference at One Metre from the Ground.	Where growr.
	Years.	Metres.	
1862	12	1·52	Jardin d'Essai, upper part.
1863	11	1·42	,, ,,
1864	10	1·28	,, road-side.
1867	7	0·90	M. Trottier's, Hussein-Dey.
1871	3	0·30	Maison Carrée.

These results were obtained not under the most favourable circumstances. During the last few days I measured one, planted in deep and fresh alluvial soil, nine years of age, and 1·57 metres in circumference, about six inches more than I could embrace with both arms. In Australia the mean height of very old trees is said to be between 60 and 70 metres, and their mean circumference from 6 to 8 metres.

Pecuniary Results of Plantation.—M. Trottier gives the following as the pecuniary results he thinks obtainable from a hectare of land planted with Eucalyptus :—

Age of Trees.	Length of Trunk.	Mean Circumference.	Price per Cubic Metre.	Value of the Cut.	Employment of Timber.
Years.	Metres.	Metres.	Francs.	Francs.	
3	5	0·20	...	·500	As staves.
6	8	0·75	20	3·120	Carpentry, telegraph posts, &c.
10	9	1·30	30	7·140	Railway sleepers.
15	10	1·85	40	12·160	Large timber.
20	12	2·30	50	27·900	,, ,,

Thus a plantation of one hectare which gives appreciable results in the third year will yield in the tenth a minimum of 7,000 fr., and in double the time it ought to produce four times the value. This estimate may be exaggerated, but even allowing a liberal margin for pardonable enthusiasm, the result cannot fail to be most remunerative.

But to arrive at the best results with Eucalyptus they must be planted in the best land, and for the first years at least be carefully cultivated. Thus treated they may be expected to realize immense returns. For instance, the average yield of a hectare planted in cereals in Algeria may be estimated at 250 fr., and without taking any account of the years when such land must of necessity remain fallow, the total produce in twenty years may be stated at 5,000 fr.

During those twenty years the cost of cultivation, the value of the seed, the transport to market, &c., may be considered as equivalent to the cost of planting the same area in Eucalyptus, tending the trees, and finally cutting them down. According to the preceding table the timber would then have a value of 27,900 fr., or for the sake of being well within the mark, say 20,000 fr. If the cultivator has to remain a long time without any return for his money, surely the result is worth waiting for.

Effect of Increased Care in Cultivation.—The time during which these trees occupy the soil may be divided into two periods of ten years each, the first the period of growth, the second period during which the ligneous products are condensed and consolidated.

If during the first period the land is kept clear, and the same amount of culture is given to the trees as would be given to a vineyard, the cost, calculating 5 per cent. interest on the sums successively expended, might amount in round numbers to 1,000 fr. During the second period no care of any kind would be required. Under the circumstances there is every reason to suppose that the trees would make as much progress in twenty years as they otherwise would in thirty. The cost of this extra care would amount to 1,000 fr., and the profit to 13,000 fr.

Comparison between Oak and Eucalyptus.—According to the tables of Cotta a hectare of land produces 450 cubic metres of oak in 100 years, the value of which at 105 fr. the metre amounts to 47,235 fr.

The same quantity of Eucalyptus wood might be produced in twenty years, and would realize 20,000 fr. This sum of money placed at compound interest from 20 to 100 years would give the enormous sum of 816,800 fr.

Danger of Fire.—No doubt that with so highly inflammable a substance as Eucalyptus wood, and with leaves so rich in essential oil, the risk of fire is a matter to be taken into serious account. It cannot, however, be much greater than in a pine forest, and the danger may to some extent be guarded against by planting the land in blocks of 10 hectares each, and leaving a wide space between them, which may be utilized either for the cultivation of cereals or as pasture land.

In the case of a pine forest catching fire, the destruction to the trees is absolute. Eucalyptus, though checked in its growth for the time, sends out fresh shoots in many cases.

Species of Eucalyptus.—The number of species of Eucalyptus is infinite, but for the purposes of commerce two, or perhaps three species only should be cultivated. The first, the *Eucalyptus globulus*, or blue gum, is best suited to warm positions, deep fresh and moist soil. The second, *Eucalyptus resinfera*, or red gum, resists drought in a remarkable manner, and should be used in poorer or drier soil, or at greater altitudes than the other. It is hardly probable, however, that either of them will thrive well at a greater altitude than 200 or 300 metres above the level of the sea. The third species, which promises well, is the *Eucalyptus colossea*, but hitherto our experience of it is limited, and we have not sufficient data on which to calculate its rate of growth.

Sanitary Effects of Eucalyptus.—There is another point of view from which the cultivation of Eucalyptus must be regarded, namely, its action in improving the sanitary condition of unhealthy districts, and in dissipating miasmatic influences, which created such havoc amongst the colonists in the first years after the conquest.

To place this subject as far as possible beyond doubt, an inquiry was instituted by the Society of Physical and Natural Sciences at Algiers, under the presidency of Dr. Bertherand, and reports were received from thirty localities, extracts from a very few of which only are here given.

Eucalyptus at Lake Fetzara.—In 1869, 60,000 young trees of *Eucalyptus globulus* were planted on the banks of Lake Fetzara, near Bône ; now they have attained the height of 7 or 8 metres each, and have produced a very marked effect on the locality.

Such was the feverish condition of this district on the annual fall of the water and the denudation of its banks, that the Director of the Jardin d'Essai, who went to examine the condition of the plants, was immediately seized with a violent fever, which lasted twenty days. That same gentleman now reports that the miasmatic influences which affected him so strongly there have disappeared, and the mosquitoes which rendered the place unin habitable have disappeared with them.

Eucalyptus at Mokta el-Hadid.—Formerly it was impossible for the workmen at the great iron mines of Mokta el-Hadid to remain there during summer; those who attempted to do so died, and the company was obliged to take the labourers to the mines by train every morning and to carry them back to Bône every night, a distance of 33 kilos. each way. From 1868 to 1870 the company planted more than 100,000 Eucalyptus, and now the workmen are able to live all the year through on the scene of their labour. The entire works and the railway leading to them are bordered with thick belts of these trees, and each of the miners has his cottage and kitchen-garden surrounded with them.

Eucalyptus at the Maison Carée.—At the mill of St. Corinne, belonging to the late M. Saulière, at the Maison Carée, near Algiers, a marsh situated to the south of it rendered the place uninhabitable at certain seasons of the year.

M. Saulière, in despair at having to renew his workmen every two

months, called in the services of Dr. Payn, begged him to visit the place regularly, and placed liberally at his disposal every remedial agent that he could suggest. Dr. Payn proposed that the marsh should be planted with Eucalyptus. In two years these trees attained a gigantic size, and fever almost entirely disappeared.

Method by which Eucalyptus improves Climate.—It is unnecessary to multiply instances, almost every one of the thirty competent persons interrogated bore testimony to the fact that the introduction of this tree had exercised a salutary influence on the health of the district.

In some places the trees destroyed miasma by utilizing the moisture of the soil in which they were planted, and thus draining marshes. The emanations from their leaves also may have produced a salutary effect. They contain a large quantity of essential oil very similar to turpentine, which they emit in great quantities, especially when stirred by the wind, and this acts, it is supposed, as a febrifuge.

Localities suited for the Growth of Eucalyptus.—There is another subject worthy of consideration, the localities best suited to the growth of the plant on a large scale, and the price of land available for the purpose.

To ensure the commercial success of the scheme the trees must be planted on a line of railway and as close as possible to a station. The soil ought to be rich and deep, and there ought to be sufficient water available for irrigating the trees during the first year, not frequently, but once when they are planted in autumn, and twice or thrice during the course of the subsequent summer. They will grow in the driest soil, but their growth is infinitely more rapid when planted under the above conditions.

Plain of Metidja.—There is no doubt that the locality which fulfils these conditions best is the plain of the Metidja. Between Algiers and Blidah, on the line of rail, it is hardly possible to obtain land for less than 500 to 700 francs the hectare: some has recently been sold for 10,000 francs. Further from the railway it may be had in some few places for 300 francs, but the cost of transport would neutralize the saving.

Plains of the Chelif and Mina.—In the plains of the Chelif and the Mina there is an enormous quantity of land which may still be obtained for a merely nominal price. It would be an immense boon to the country if some of this were planted with Eucalyptus, but the chances of profit to the cultivator would not be so certain. The soil is hardly inferior to that of the Metidja, but the hydrometrical conditions of its climate are very different. The range of hills stretching westward from Miliana cuts it off from the sea breezes, which always afford a certain quantity of moisture, rain is more scarce, and the farmer can hardly hope for more than one good year out of three. From Affreville, where it commences, to Oran, is a distance of about 300 kil. It is traversed by the most important river in Algeria, the Chelif, which rises in the Sahara and falls into the sea near Mostaganem.

Barrage of the Chelif.—A barrage has been built near Orleansville, and it is possible that there may be good irrigable land procurable in that locality, but as it is the only part of the plain which I did not carefully inspect, and the only irrigational work that I did not see, I cannot speak

positively on the subject. I have been assured, however, by the Government of Algeria that from 2,000 to 3,000 hectares of land, situated between the Oued Ouran and the Oued Ras, irrigable by the barrage of the Chelif, might be found there well suited for the purpose.

Barrage of La Djidiouia.—The most important barrages are in the valleys on the south side of the river, at La Djidiouia, 263 kil. from Algiers; a magnificent dam of cut stone and hydraulic cement has been built across a gorge in the course of the river, thus forming a lake, containing 2,000,000 cubic metres of water.

Barrage of the Mina.—At Relizane there is a barrage of another nature; at a spot where the river Mina leaves the level plain in which it has hitherto flowed to enter by a series of rapids a lower rocky bed, a dyke has been constructed to raise its level and to divert the water into canals on either side for the irrigation of the country around.

Barrage of the Oued Ferzoug.—The finest of all, however, is the barrage of the Oued Ferzoug, near Perregaux, 346 kil. from Algiers, and 76 kil. from Oran. This work, as well as the railway now being constructed between Arzew and Saïda, is due to the private enterprise of M. Debrousse, who has received no guarantee of interest, but a concession of 24,000 hectares of irrigable land between Perregaux and the sea, most of which is at present unreclaimed, either in the state of tamarisk forest or of pestilential swamp.

The barrage is situated at the junction of three rivers; it measures 500 metres in length, and contains the enormous quantity of 32,000,000 cubic metres of water. I need not allude to the other works of a similar nature, I only wish to show that, dry as the plain of the Chelif and the Mina is, there are not wanting considerable tracts of land capable of artificial irrigation.

Price of Land in the Plain of the Chelif.—The price of land is nowhere high; almost any quantity can be purchased at 50 or 60 fr. a hectare, and I was shown beautiful land, cleared and irrigable, which might be had at 100 fr.

One property particularly struck me; it consisted of 600 hectares, one side was bounded by the river Chelif, the other by the Dahra, the range of hills along its right bank. A part of it was watered by a stream descending from those mountains, and I saw on the opposite bank of the river an artesian well which brought water to the surface of the ground, from which I inferred that the same thing might be practicable on the property to which I allude. It was traversed by a high road, and a bridge across the river was about to be constructed; an important Arab market took place on the land every week; and in addition it had a large dwelling-house, which was, however, much out of repair; with all these advantages the property was for sale for 60,000 fr. (£2,400).

Considerable numbers of Eucalyptus have been planted all along the line of railway from Algiers to Oran. Where this line passes through the Metidja the trees have grown most successfully, but in the Chelif they have failed in almost every case. It is true that they have not been tended in any way, they have merely been planted and left to their fate.

In and around villages in this plain they have thriven better, but still never so well as in the Metidja, while in the marshy plain of the Macta, conceded to M. Debrousse, which at first sight appears a typical position for them, they have not done well at all. The reason for this is that the land is not yet ready for them, it has lain in a state of marsh for centuries, the subsoil is saturated with salt, and the more the trees are watered after being planted, the sooner the capillary attraction brings the salt to the surface and kills the trees and checks their growth.

Land in Province of Constantine.—These remarks apply only to the two great plains over which I have travelled this year; there are no doubt localities as good situated elsewhere, especially in the plain of Bône, and on the line of railway now being constructed to Guelma. I cannot speak with any certainty of the price of such, but regarding its suitability for the growth of Eucalyptus there can be no doubt.

On a careful consideration of the whole subject, I feel more convinced than ever that no culture in Algeria offers such prospects of success as Eucalyptus, if the cultivator can afford to remain for a considerable time without any return for his capital, that in the long run it will be more economical to purchase land for the purpose at 600 fr. a hectare than at 60 fr., but that to ensure success the experiment should be made close to a line of railway and in a comparatively cool and salubrious position.

Longleat Estate Timber Sale.

The annual sale of timber on the Longleat Estates, Wilts, took place at Horningsham on the 10th of August, at which there was a large attendance of buyers, and the bidding was kept up with great briskness throughout the sale, which turned out a very satisfactory one. Excellent prices were realized considering the dull state of the timber trade, and that the timber exposed for sale was of comparatively small dimensions. The sale was ably conducted by Mr. Bedford, auctioneer, Warminster; the marking, lotting, and the giving of the necessary information to intending purchasers being under the superintendence of Mr. Berry, forester on the Longleat Estates. The terms of sale required purchasers under five pounds to pay in full the amount of their purchases immediately after the sale; but purchasers above five pounds might pay a deposit of not less than 10 per cent. at the close of the sale, and give a bill payable on demand, with approved security, for the balance.

The sale realized a total of £956 4s. 10d.; the previously estimated value being £859 10s. 1d.; a result highly satisfactory to all concerned.

The following table contains a few particulars of the timber sold, and the average prices realized, the latter comparing favourably with the prices obtained this season at other sales of home-grown timber, of a similar description, in the south-west of England.

No. of Lots.	Description of Timber, &c.	No. of Trees.	Average contents in cubic ft.	Average price per cubic ft. s.	d.
1 to 5	Oak—in Lower Hunter's Hill Copse	100	16	2	2
6 „ 14	Oak—in Potsherd Copse	187	12	2	1
15	Oak, second quality—Wind Hill ...	6	21½	2	0
16	Oak, rough quality—on Thoulstone Farm	3	15	1	8
17 and 18	Beech—Gaisford Screen	31	30	1	3
19 to 26	Beech—Wind Hill	135	19	1	3¼
27 and 28	Ash—Gaisford Screen	26	21	2	7
29	Ash, hedgerow—Horningsham Common	13	14	1	4
30	Ash—Thoulstone Farm	3	13	2	0
31	9 ash, 2 elm, 1 abele, 1 hornbeam—Brickhill Copse	13	10	1	5½
32	5 ash, 8 birch, 4 Spanish chestnut, and 4 sycamore—Wind Hill Park ...	21	14	1	0
33	1 ash, 6 abele—Lower Hunter's Hill Copse	7	14	1	1
34	Elm—on Mr. Leonard's Farm ...	1	30	1	1
35	Elm—New Church Farm	6	20	1	2½
36	8 elm, 2 beech—at Cole Hill ...	10	12	1	4
37	Elm—Horningsham Common ...	1	56	1	1
38	1 abele, 5 ash—Cole Hill, &c. ...	6	11½	1	4¼
39	2 larch, 15 Scots fir, 2 spruce fir, very rough except larch—Gaisford Screen	19	12½	0	11½
40	Spanish chestnut—Gaisford Screen ...	2	22	1	2
				Each.	
41	Oak, &c., saplings—Hunter's Hill Copse	31		4	6
42	„ „ —Potsherd Copse	43		3	9
43	„ „ —Gaisford Screen ...	66		5	4
44	„ „ —Wind Hill ...	36		5	3
45	Oak, &c., poles—Gaisford Screen ...	170		2	1
46	Fir Poles—Southley Wood	23		2	5
				Per 100.	
47 to 63	Oak-top and other fagots, sixscore to the hundred—Potsherd Copse ...			16	0
64 „ 74	„ „ —Gaisford Screen ...			21	3
75 „ 85	„ „ „ ...			29	0

Under the title of "Die Douglas Fichte" Mr. John Booth, of the Flottbeck Nurseries, has published an account of the Douglas Fir, and other Firs of North-west America. The species particularly alluded to with reference to their introduction to Germany are *Abies Douglasii*, *A. Nordmanniana*, *Libocedrus decurrens*, *Cupressus Lawsoniana*, and *Sequoia* (*Wellingtonia*) *gigantea*. Photographs of these are given, and brief details of the size and appearance of the trees in their native countries, as also when cultivated.

The *Berliner Monatsschrift* for June contains a plate of the fine old Weymouth Pine existing in the Royal Gardens at Berlin. It is about 70 feet high, and nearly 10 feet in girth at 2 feet above the ground. The tree is of irregular but picturesque growth, and it has already suffered from the effects of high winds. Nothing certain is known as to its age, though it is probable it was planted soon after its introduction into Europe. Unfortunately this interesting tree begins to show signs of decay, and for that reason the editors of the journal in question have hastened to secure its portrait.—*Gardener's Chronicle.*

Tree Planting in Algeria.—For some years past the colonists, encouraged by high prices and the success obtained by the great companies, have begun to make plantations of trees, amongst which the Eucalyptus predominates. To give still further encouragement, the Government has proposed that plantations should be made in every commune, and it will share the expense. From an inquiry lately held by the *Société de Climatologie* of Algeria, it results that wherever the Eucalyptus has been planted to a large extent the intermittent fevers, so common in the marshy districts, have diminished in frequency and intensity.

The German Forests.—If the accounts we hear of the change in the climate of Germany during the last fifty years be true, it cannot be on account of the disappearance of the forests. The Department of Agriculture says:—"In the distribution of the kinds of wood the pine and fir are found in the south of Germany, oak and beech in the west and south-west, and the Scotch fir in the north and north-east, while Central Germany, to a greater or less degree, contains all these varieties. Since 1831 the forest area of Prussia has diminished about 5 per cent.; in most of the other German states a barely appreciable diminution has taken place, while there has been a steady increase in Bavaria, Baden, and Saxony. On the whole, Germany has wood enough to meet domestic demand for many years to come."

The Colorado Beetle in Scotland.—A small box similar to those in which vestas are sold in this country, and bearing the post-mark of a town in Canada, arrived at the Macduff Post Office last week. The box (says the *Banffshire Journal*) was addressed to an individual in the Macduff district. It was a little open, and the postmaster saw an insect in it which he was able to identify

as a living Colorado beetle. On being examined the box was found to contain a dozen of these dreaded insects. The postmaster at once telegraphed to the Surveyor-General for instructions. A reply was wired informing him to destroy the beetles immediately. This was done by administering chloroform. As the box was seen to contain several eggs, in order to ensure that the destruction was complete, it was burned. We believe a couple of the dead insects have been sent to the County Museum in Banff.

Large Walnut and other Trees.—Allow me to bring under the notice of your readers a very fine walnut tree growing at Edmonstone, near Edinburgh, the seat of Sir J. D. Wauchope, Bart. Its girth at 3 feet above the ground, where it divides into three limbs, is 16 feet 9 inches; the girth of the limbs severally is 8 feet 8 inches, 8 feet 6 inches, and 6 feet 2 inches; the branches cover a circumference of 242 feet. At the same place there are also some fine Spanish chestnuts. The girth of one of these at 3 feet above the ground is 15 feet 3 inches, and at 6 feet 6 inches from the ground, where it divides into two limbs, it is 18 feet 9 inches. Another of these at 3 feet above the ground measures 14 feet 6 inches. I may also mention that there is at the same place an oak grown from an acorn planted by the present proprietor's grandfather, about 110 years ago, which now measures 12 feet 6 inches at 3 feet from the ground. There are also two handsome tulip trees in the grounds, one of which has flowered profusely every year for certainly upwards of fifty years. Unfortunately this was much damaged last year by an unusually early snowstorm in November before the leaves were off the tree.—*Scotia.*

There is a large walnut tree at Leversdown, near Bridgewater. Its girth 2 feet above the ground is 17 feet; and at 5 feet, 14 feet 8 inches; the length of the stem up to the crown is 10 feet; girth of first branch, 10 feet; circumference of branches, 275 feet. The branches would have covered a greater circumference, but a huge limb was blown down a few years ago.—*D. K. T.*

Preserving Posts.—I notice in your paper the advocacy of coal tar as applied to the ground end of fence-posts, making them equal to cedar. I will give you my experience. Years ago I bought a number of sawed chestnut posts, 5 inches square at the butts. I applied the coal tar, and gave it time to dry before planting them. So particular was I to make them last, that in place of filling up the hole with the soil dug out, I built them in with small stones and rich mortar, thinking by this extra expense to make them last equal to cedar. But my labour was in vain; in seven or eight years they rotted off at the surface of the ground.

If I had it to do again, I would buy a barrel of coal oil (kerosene in its crude state), take one end out of the cask, set the posts in it, butt end three feet deep, as many as it would hold at a time, and let them remain till well saturated, the longer the better. I would then take out and let dry, not exposing to the sun; then give a good smearing with coal tar boiling hot, and then a good dusting with fine dry sand; this would form a body or coating to the post. Two applications of this would be still better, giving the first time to dry; then let both become dry before planting. This coating should extend at least six inches on the post above the surface of the ground when planted. Care must be taken not to injure this coating in pounding in the earth in planting the post. Crude oil should be placed in an out-of-the-way or isolated place, away from dwelling or farm buildings.—*Country Gentleman.*

To Preserve Fence Posts.—The *American Chemist* says that a western

farmer discovered many years ago that wood could be made to last longer than iron in the ground. Time and weather, he says, seem to have no effect on it. The posts can be prepared for less than two cents apiece. This is the recipe: Take boiled linseed oil and stir it in pulverized charcoal to the consistency of paint. Put a coat of this over the timber, and, he adds, there is not a man who will live to see it rot.

Trees and Electricity.—We gave an account the other day of some of M. de Moncel's observations on the electric conductivity of trees. In a further note to the French Academy he gives a table of the comparative resistances of a large number of trees. The method of experiment was to apply two platinum electrodes of square surface, one at the upper part and the other at the base of the tree; they were 6·44 m. apart, and the lower electrode placed slightly above the ground. Such an arrangement with a galvanometer itself gives a current from above downwards through the galvanometer; and this had to be allowed for before the battery (of three Daniell elements) was connected. The table shows that soft woods of spongy tissue and vigorous vegetation, such as elm, chestnut, lime, poplar, &c., are the best conductors, while the hard woods of slow vegetation are the most resistant. Birch seems to form an exception. The order of conductivity is pretty much the same as that of the same woods when dry and exposed to moisture.—*English Mechanic.*

Sale of Dumfriesshire Estates.—At Messrs. Lyon & Turnbull's Rooms, Edinburgh, the lands and estates of Hoddam, Dumfriesshire, which belonged to the late W. J. Sharpe, of Hoddam, were exposed for sale on the 1st ult. There was a large attendance of landed proprietors and professional gentlemen, and after some spirited bidding the lots were sold as follows:—The main estate of Hoddam, lying in the parishes of Annan, Cnmmertrees, Hoddam, and St. Mungo, and extending to 4,200 acres, was put up at the upset price £180,000, and knocked down to Mr. Edward Brook, of Meltham Hall, Huddersfield, Yorkshire, for £200,500. The lands of Middlebie, in the parish of Middlebie, extending to 770 acres, were purchased by Mr. Archibald Stewart, W.S., for a client, at the cost of £24,500, being an advance of £2,000 on the upset price. The farm of Hallidayhill, in the parish of Dalton, extending to 350 acres, was bought by Mr. C. R. Bedford, of Knockhill, Ecclefechan, for £8,050, the upset price being £7,500. The farm of Cowthat, in the parish of Hoddam, was put up for £5,250, and sold for £6,125 to Dr. Arnott, of Kirkconnel, Ecclefechan. The farm of Burnswarklees, in the parish of Hoddam, was sold for £1,720, being an advance of £120 on the upset price, to Mr. Archibald Stewart, W.S., for a client.

The estate of Rosebank, near Lockerbie, Dumfriesshire, extending to about 200 acres, was lately sold, at Lockerbie, to Mr. William Sanders, Westwood, Lockerbie, for £16,450.

Trees in London.—The plane trees in the City of London are at the present time in the most perfect state of leafage and colour. The limes have lost their brightness, the elms are of a deep sombre green hue, but the planes are golden green and glorious in the sunshine. An amusing study of town trees may be pursued in a walk through the gardens of the Temple, and thence along the Thames Embankment. The well-known Fountain Court is now exquisitely beautiful, and we recommend any one interested in City trees to visit the spot while it is at its best—on one side delicately garlanded with greenery, and the fountain throwing its simple column of water beside one of the finest plane

trees in London. The plane trees of the Temple have been but little pruned at any time, and they contrast in striking manner with the lean, systematically pruned trees on the Embankment.—*Gardener's Magazine.*

Forests in Europe.—If there is any change in the climate of Europe, it can hardly be from the disappearance of forests. Recent statistics say that about twenty per cent. of the whole area of Europe is covered with forest, aggregating 500,000,000 acres. We do not, however, regard these floating figures as always reliable, but give them as they come to us. There is a great deal of loose calculation going on in the world.—*American Horticulturist.*

The Products of Oak Timber.—The following extract shows the incidental profits that may be made from the produce of an oak plantation, although we doubt whether for paper-making purposes any timber tree will be found so profitable as poplar, which comes so quickly to a useful size. Dr. Mitscherlich, of Dramstadt, has invented a method of making paper-stock (cellulose) from wood by a chemical process, which differs somewhat from those previously in use. The chief peculiarity of this process, which is in use already in Prussia and Saxony, says the *Hesse Gewerbeblatt*, consists in this, that the incrusting substance of the wood is not destroyed, but only separated from the cellulose, and eventually rendered soluble.

"In this process it is not necessary to cut the wood up very fine, as in the Sinclair process, but only to split it up like ordinary firewood for a parlour stove. A chemically prepared solution of lime is boiled for six hours with the wood under a pressure of three atmospheres. After the boiling, a portion of the incrusting material is found dissolved in the liquor, and part of it in the pores of the wood, from which it is extracted by a suitable squeezing apparatus.

"If it is desired to make a very valuable paper-stock, which shall be as white as possible without bleaching, they only employ white wood as free from rosin as possible, like poplar, linden, &c. These kinds of woods are not decolourized any farther in this process, and the albuminoid and gummy substances are mostly dissolved. The success of this process depends less on the pressure during boiling than on the temperature, which must not exceed 248° Fahr.

"The use of oak wood for paper-stock offers one advantage, namely, that the tannin contained in it is obtained as a by-product, and the solution thus obtained can be very profitably employed for tanning, as experiments in this direction have abundantly proved. The solution which runs off from the wood, or is expressed from it, in this new process, is already so concentrated that evaporation seems superfluous, and is only undertaken when a very concentrated solution is required either for transportation or for keeping. The other chemicals contained in the lye are in no way a hindrance to the tanning process, but rather aid it. Experiments show that hides prepared in the usual manner, when simply laid in this liquor, were perfectly tanned in ten days."

Pine Tree Oil.—In the vast sandy and marshy plains called "Landes," extending along the shores of the Bay of Biscay, and far inland, between the Garonne and the Adour, the *Pinus pinaster* is extensively cultivated on what was a dreary barren waste less than a hundred years ago; and besides sheltering the country and preventing the drifting of the loose land, this pine yields a lucrative produce in tar, resin and pitch, which the inhabitants carefully collect and prepare for the market as their chief means of earning a

living. From the resin thus brought to market M. Guillemare informs the French Academy of Sciences that he has produced three kinds of oil, all rich in illuminating power—containing respectively 80, 90, and 92 per cent. of pure carbon. The oil is said to burn with extraordinary brightness and steadiness; and it is affirmed to be well adapted for lighthouses and other purposes of illumination requiring a strong and brilliant light.

Siamese Twin Elms.—At Leybourne Grange, near Maidstone, are two elms, about two feet apart, which are united about seven feet from the ground by a branch 2½ feet through.—*G. S. B.*

Erratum.—In the paragraph headed "Value of Timber in the Highlands," in our last number, page 301, the extent of the two hills, planted in 1820, is 300 acres, and not 800, as there stated by a printer's mistake.

A Gigantic Tree.—The largest tree standing in the United States, says the Invo (Cal.) *Independent*, is on the head of Bear Creek, north fork of Toole River. The exact dimensions of this immense redwood giant is something over 46 feet in diameter.

Californian Chestnut.—At a recent meeting of the Californian Academy of Natural Sciences, Dr. Kellogg said he had just returned from under the shadow of the finest evergreens ever grown. He hoped the secretary would record the fact that there were in California Golden Chestnut Trees (*Castanea chrysophella*) from 100 to 200 feet high, 4 to 6 feet in diameter, and with an unbranched trunk of from 50 to 70 feet.

How to Cure a Sting.—To cure a sting from a bee, bite from a midge, gnat, or any other noxious fly, touch the part stung or bitten with pure glycerine, and the effect is relief *instanter*.—*D S. S.*

The Foresters at Windsor.—The annual fête and athletic sports held by the foresters employed upon the royal demesne at Cumberland Lodge, Windsor Great Park, were presided over by the Prince and Princess Christian. The proceedings took place upon the greensward opposite the lodge. Early in the afternoon Prince and Princess Christian arrived, attended by Colonel Gordon. About five o'clock dinner was served in a large marquee to 140 of the foresters, Colonel the Hon. A. Liddell, the deputy-ranger, presiding. While the foresters were dining Prince and Princess Christian entertained company in another marquee.

The Kishorn and Lochcarron Estates, Ross-shire.—The estates of Kishorn and Lochcarron, extending to about 33,000 acres, which were purchased by the late Vice-Chancellor Sir John Stuart from the late Duke of Leeds, were lately sold by private bargain for about £100,000. These estates were but a small portion of the Applecross property, purchased by his Grace little more than twenty years ago for £140,000. It may be noticed that on the Kishorn and Lochcarron estates even extensive sheep farmers were without leases under the late proprietor.

Appointment.—Mr. D. F. M'Kenzie has been appointed forester to Sir Douglas Steuart, Bart., on his beautiful estates of Murtly, Grandtully and Strathallan. The ancestor of Sir Douglas Steuart, the first baronet, was a distinguished arboriculturist, and is famous as the founder of the art of transplanting trees.

THE summer season's work in our forests and plantations being completed, the forester should now have some leisure time at his disposal, before the busy planting season commences, which, with the sanction and encouraging assistance of his employer, ought to be devoted to visiting the woods and plantations on other estates, more especially those noted for their good management, and the extent and variety of the operations and improvements conducted upon them. With such cheap and expeditious means of travelling as we now possess, which entail no great sacrifice of either time or money, foresters should be enabled by their employers to make an annual excursion of a week or two's duration among the woods and plantations in their own district, and afterwards extend their peregrinations to those in distant parts of Great Britain, and even in course of time to the great forests and Forest Schools of Continental Europe, so that they might see and become acquainted with the best systems of forestry followed in the different districts of the country; they would thereby acquire a knowledge of their profession, in many of its varied features, which it is almost impossible for them to do by any other means, resulting, we believe, in the marked improvement of the majority of our woodlands and plantations, and the consequent greatly increased returns from their produce to the proprietors of them.

We are aware that the slender means of most of our foresters will not permit of very extensive or long continued journeys, but landed proprietors who employ foresters, and study their own interests as well as the happiness and prosperity of their employés, will not fail to see that their foresters are provided with the necessary means for enjoying a tour of visiting amongst their brethren of the craft, inspecting in their company the woods, &c., under their charge, discussing the

various operations of forestry, and the methods found most suitable in the different localities, comparing notes of each other's experience, and giving and receiving information upon a multitude of topics of the greatest interest to foresters. By such means a healthy emulation is excited amongst them, their professional knowledge extended, and their ideas and abilities invigorated, so that they return to their duties with refreshed energies, and a determination to adopt only the best and most approved methods of forestal operations suited to the locality and circumstances in which they are placed, and which must ultimately result in a vastly improved system of management of the woods and plantations of the country, and the greatly increased profits realized to the proprietors, besides adding immensely to the prosperity and amenity of the country in general.

When a few days only can be spared, neighbouring estates should first be visited, and the woodlands upon them carefully inspected, as they are most likely to afford many points of interest peculiar to the district, which the intelligent forester will study with advantage and may find suitable for adoption or improving upon at home. When a week or two can be devoted to an arboricultural tour, it will naturally extend to more distant parts of the country, and embrace visits to the more celebrated of the forest and ornamental nurseries, botanic gardens, public parks, &c., where an intelligent and observant man will always find much to interest and instruct him. Whether the time at the disposal of the arboriculturist be long or short, his journey should always be so adjusted as to give him ample time and opportunity to gather all the useful information which can readily be obtained from each place visited, as nothing can be less profitable than mere "sight-seeing," when adequate time is not taken to fully understand and mentally digest whatever objects of interest are presented to our view.

It is scarcely necessary for us to express an opinion upon the advantages to our foresters if they had an opportunity given them to visit the celebrated Forest Schools of Germany, France, and other enterprising European States, and to inspect the vast natural forests of those countries, until such times as a vigorous spirit of professional inquiry is stirred up and exhibited amongst them, and their employers see it is to their interest, and deem it their duty, to encourage and foster a taste for improvement and a general knowledge of the best systems of forestry, when a tour through the continental forests will become more common than a trip through our home forests and plantations is at the present day.

Those foresters who intend planting during the ensuing season, and who do not possess that valuable addition to an estate, a home nursery, should take an early opportunity of visiting the nurseries from which they intend to make their purchases, and select the stock of young plants which they are likely to require before the leaf falls, and while it can be easily seen that they have made a clean, vigorous growth, unaffected by either insects, blight, rust, mildew, &c. If the greatest success in planting is desired, nothing tends more to secure it than the careful selection of the young trees from a clean, healthy, free-grown, well-rooted, and properly ripened stock, and the early part of this month is the best time for observing whether or not nursery stock possesses all or only some of these advantages. All young trees should be closely examined before purchasing, to see that they are not infested with insects, or been injured during their period of growth by "blight" of any kind, and if they are found to be either the one or the other, they ought not to be purchased at any price, as they are certain to cause much loss and disappointment, if they do not soon end in an entire failure. There can be no greater waste of money than planting weak, damaged, or sickly trees, and foresters ought always try to secure the very best quality of plants, of a suitable age and size, for the planting they have on hand. This can be best insured by a personal inspection of the young trees, after they have made their season's growth, and before deciduous kinds have shed their leaves, when it can be easily perceived if they have made a healthy growth and are ripening properly, or if they have suffered injury during growth from blight or insect pests, when they ought to be at once discarded, selecting for use nothing but clean, healthy, robust plants.

In conclusion, we would draw the attention of our readers to the excellent practical advice and instructions given by our able contributors in this and other numbers of the journal, upon the best methods of preparing the ground and making new plantations with the greatest certainty of complete success.

At the Great International Show held at Carlisle on the 6th, 7th, and 8th ult., splendid collections of Coniferous Plants were exhibited by Messrs. Barron and Son, Elvaston Nurseries, Borrowash; Dickson and Turnbull, Perth; and Little and Ballantyne, Carlisle, to whom the prizes were awarded in the order named. The last named, and Messrs. Clark Bros., also exhibited very fine miscellaneous

collections of conifers; and Mr. J. G. Alberts, Boscoop, Netherlands, exhibited a very choice and select group of hollies, containing many of the best and most distinct varieties of the plain and variegated leaved kinds. The whole of the collections named were arranged with fine effect in the open air on the side of the show ground next the river Eden, and were perhaps the only exhibits in the whole of the Grand Show which suffered nothing in effect from the torrents of rain which poured down throughout the opening day. In the class for fifteen specimens Messrs. Barron and Son exhibited splendid well-grown and handsomely furnished examples of *Abies Alcoquiana*, *A.Parryana*, *Picea bracteata*, *P. magnifica*, *P. Nordmanniana*, and *P. Parsonsiana*; *Retinospora plumosa aurea*, *R. filifera*, and *R. obtusa compacta*; *Arthrotaxus selaginoides*, *Biota elegantissima*, *Cupressus Lawsoniana lutea*, and *erecta viridis*, *Thujopsis dolobrata variegata*, and *T. Standishu*. For six hardy conifers not yet introduced into commerce, Messrs. Barron and Son were also first with nice examples of *Picea concolor*, *Retinospora tetragona aurea*, *Podocarpus Alpina*, *Cupressus Lawsoniana elegantissima*, *Wellingtonia gigantea lutea*, and *Retinospora pisifera aurea*. Messrs. Barron and Son also exhibited an extensive collection of nice small plants of new and rare Coniferæ, which were much admired, and contained amongst them many rare and beautiful varieties.

The first prize offered for the best "new Conifer of real merit" was well won by Messrs. Little and Ballantyne, with a fine specimen of their new weeping *Wellingtonia gigantea pendula vera*, a most elegant and handsome variety, which is well worth the notice of all lovers of graceful and distinct trees, and must soon find its way into all the collections of Coniferæ of note in the country.

Cultural First Principles.

By G. S. BOULGER, F.L.S., F.G.S., late Professor of Natural History in the Agricultural College, Cirencester.

II. The Nature of the Soil.

The science of geology as usually taught is of little use to the practical forester. Except where questions of water supply arise he need care little for gault, lias, or oolite, and certainly cannot afford the time or mental labour necessary to enable him to recognise strata by their fossils. The scientific look of an advertisement of "grasses for the different geological formations" pays, no doubt, but, as a matter of fact, it would puzzle an astute botanist to say whether he was on clay of liassic, Oxfordian, Kimmeridgian, aptian, albian, or wealden age, judging merely from the flora. The "father of English geology," William Smith, was thus led to confuse formations of very different geological age, though physically alike, under the name "oak-tree clay," from the luxuriance of that species upon them. Except in very new countries the cultivator now-a-days can procure a map of the geology of his district; but he will not require such assistance to enable him to distinguish a clay from a sandstone, or gravel from a limestone. In fact, the cultivator requires a knowledge not of geology, but of the as yet unnamed and unrecognised science of soils.

The soil plays two parts with regard to trees: it gives them a solid basis to grow upon, and it supplies them with water, containing in solution some of the substances necessary for their nutrition. By far the greater part of the bulk of our forest trees is made up of carbon, derived from the carbonic acid or carbon dioxide of the air, in combination with the elements hydrogen and oxygen, derived from pure water.

Since, however, plants cannot take in solid food, all the so-called inorganic substances they require must be introduced in solution through the roots. The greater part of this—lime, silica, potash, soda, magnesia, and phosphorus, being returned annually to the soil by the falling leaves and fruit, it will be seen that the physical characters of a soil, may well be more important than its chemical composition. Nevertheless a chemical analysis of the soil may be

even more suggestive to the tree grower than a knowledge of its geological age is likely to be.

The constituents of a soil, physically speaking, are usually stones, gravel, sand, clay, organic matter, and moisture, and on the proportion in which these are present many of the physical properties of the soil depend. Their proportion is no less important in a chemical point of view, the mechanical condition of the materials of a soil largely affecting the availability of its chemical ingredients.

The chief physical properties of the soil are depth, hygroscopicity, compactness, and colour; of which the first two are by far the most important.

Of these, depth needs no definition; but I may here remark that the subsoil is comparatively unimportant, the whole upper layer of the earth, whatever its composition, which is capable of being penetrated by the roots of the plants, being known as the *topsoil.* That portion of the topsoil which is formed by organic *débris* in a state of decomposition is known as *humus* or vegetable mould.

The hygroscopicity of a soil is the facility with which it absorbs and retains water, and is in proportion to its compactness.

The compactness of a soil is also of importance as determining its permeability to the roots of trees.

On the colour of the soil, as I mentioned in my last article, depends its power of absorbing heat.

The best forest soil is deep, dark-coloured, and moderately compact.

Compact clays, or fine sand, constitute *heavy* or *stiff* soils, which are also said to be *cold* on account of the large amount of water they contain; while limestone, and more or less gritty sand, on the other hand, constitute *light, warm* soils.

A soil containing much vegetable mould is *rich;* one containing little, *poor.*

With regard to the quantity of water they contain, soils may be classified as *marshy* when covered with stagnant water, and thus unfit for trees; *aquatic,* those which are so saturated with water that it appears under the pressure of the foot, but can drain away. The elm, ash, poplar, willows, and alder will grow on such soil; *damp,* where water does not appear, but which never dries up in any season. *Quercus pedunculata,* spruce fir, elm, ash, alder, and others grow here; *moist,* which do not dry up to a greater depth than four or six inches, in which almost every species will grow; and *dry,* on which grow the birch, Scotch fir, Austrian, cluster (*P. pinaster*), and other pines.

Soils are composed chemically of siliceous, argillaceous, and calcareous matter, variously mixed,—that is of sand, clay, and limestone. *Sand,* when very fine, has the same compactness and hygroscopicity

as clay, these properties merely depending on the fine state of division of the matter. More often, however, sand constitutes a light, porous soil. It is at best a poor, unnutritious soil, though when fine, better than pure clay or limestone. *Clay* is so compact, so slightly absorptive, and so retentive of water, and yet so liable to become parched, that it is unsuited to vegetation, yielding no nutritive matter, and being with difficulty penetrated by the roots.

Sand and clay mixed constitute *loams*, which are spoken of as sandy or clayey if either constituent occurs in the proportion of two to one.

A *sandy loam* or *rich sand*, with humus, constitutes the best forest soil.

Limestone, in an earthy state, yields a very light porous soil, of a light colour. It dries rapidly; and thus, though of some nutritive value, is by itself unsuited to vegetation, and does not afford a sufficiently solid basis for large trees. Lime and clay mixed constitute *marl*, a most excellent soil, suitable to all kinds of plants, and highly nutritious. It exfoliates, or flakes off, when exposed to the air, and constitutes a stiff or a light soil, according as it is argillaceous or calcareous, *i.e.*, as clay or lime predominates.

We may also have a *calcareous loam*, in which a small proportion of lime, say a quarter, occurs; but a mixture of clay, lime, and sand, in almost equal parts, forms a most excellent soil.

Vegetable mould is valuable, since it absorbs and retains twice its weight of water, which it gives up more easily than clay, but less so than sand or lime; thus it acts as a corrective, besides which it renders the soil dark-coloured, and contains organic compounds in abundance suitable for the nutrition of plants.

The geology of the subsoil has often little to do with the topsoil, which may be of glacial or alluvial origin, or may be so altered by atmospheric agency as to be totally different in composition from its original condition, as when carbonate of lime is dissolved out, leaving the red residual soil on our chalk and other limestone hills almost destitute of calcium.

For most of the definitions and classifications in this paper I am again indebted to Professor Bagneris's Manual. They seem to me so clear and precise that I thought I could not do better than adopt them.

(*To be continued.*)

On Planting.

By ALFRED J. BURROWS, Pluckley, Kent.

The operations of the planter may be considered under their threefold aspects of planting for profit, for shelter, and for ornament. The two former are to some extent identical, and both may be made subservient to the latter, as the line of beauty is generally the line of utility, and the result of strict economy. In the disposition of his trees, and in drawing his line of demarcation, the forester who follows nature will at one effort produce the grandest effects, and realize the maximum amount of profit from his plantations. The natural features of any district, considered in conjunction with climate, soil, and aspect, must fix the limits of its profitable cultivation as woodland; and when the chemical constituents of the soil, and the degrees of its dryness or humidity are well known to the planter, he stands on a vantage-ground which should enable him to command success. But in assigning his limits, the mattock and spade must not be too much under the control of the square and compasses; and in his attempts to clothe with verdure the summits of barren and profitless heights, he must occasionally be allowed to obtain a footing in the richer and more fertile valleys below. Thus following the guidance of his instructress, he will crown the elevated spots with the larch, beech, birch, and pines of various kinds; fill his plains and hollows with the chestnut, oak, yew, &c., and give to moist and marshy sport the alder, willow, poplar, spruce, and the ash. At the same time, as a barrier against the winds, he will plant the beech, wych elm, hornbeam, sycamore, and mountain ash, the whole being so gradually blended as to present no harsh outlines. Having first surveyed the scene of his operations geographically, he must next consider it topographically, and in assigning their respective quarters to the different species of plants, be guided by analyses both of the soil and of the ashes of the wood of the trees he intends to propagate.

The importance of early planting in autumn cannot be overrated. There is much truth in the aphorism—"Plant *before* Martinmas (November 11) and *command* success: plant *after* Candlemas and *entreat*." By an early removal of young trees in the autumn, while the soil is

warm, and before vegetation is entirely suspended, we enable them to start off early in the spring, and fortify them against the baneful effects of summer drought. Injuries to the roots heal much more rapidly in October than they do in March or April; and by being placed out singly some time before they are assailed by the rigours of winter, the young plants become more acclimatized, and their sap vessels gradually harden. The treading and poaching of the land also is reduced to a minimum, and the soil enjoys for a time all the benefits of a complete aëration. The risk of moving is much less. than during the winter, when a sudden change of weather often suspends the operation for weeks, and the plants are kept in a transition state, technically termed "bedding in,"—to await what is not unfrequently a remote opportunity of being settled in their new abode.

In selecting trees for planting in particular localities we are too apt to "o'erstep the modesty of nature," and place them in situations utterly unsuited to their habits and requirements. Immediate loss and largely increased future expense is the result. It is well known that all plants require alkalies in the soil in a greater or less degree. Marls and clays are generally rich in these alkalies, which enter largely into the composition of the deciduous trees. Upon such soils these trees are found in the greatest abundance, and in the most vigorous state of growth; while in elevated regions, whose thin soils are more sparingly supplied with the alkalies, the pine and fir tribes luxuriate.

Trees, being largely dependent upon the atmosphere for their sustenance, will flourish in many places where the corn plants dwindle and die. By a comparison of the quantities of inorganic matter left by the straw of corn and the wood of trees, it is seen that while 1,000 lbs. of ordinary oat straw yields 60 lbs. of ashes, the same weight of poplar wood gives only 20 lbs., willow 4½ lbs., and oak only 2 lbs. Again, the leaves of trees are richer in inorganic matter than the trunks and branches: thus 1,000 lbs. of pine wood gives 3 lbs. of ashes, while the same weight of its leaves will yield from 20 to 30 lbs. In elm, the proportions are 19 lbs. from the wood, as against 120 lbs. from the leaves.

Trees, by penetrating the soil to a great depth, bring up substances in which the surface soil is often very deficient, and afterwards deposit them by their annual fall of leaves. The trees, however, differ widely in their fertilizing effects upon the land. After a crop of spruce or beech the land may be said to be impoverished: after Scotch fir it is not improved: while after a crop of ash the improvement is very perceptible. Oak, especially during the latter years of its growth, has a marked influence for good upon the soil, as its leaves

produce about 5 per cent. of saline matter. When a plantation of larch has been so far thinned as to permit the herbage to spring up plentifully, the value of the land as pasturage is often increased five or six fold. When it is stated that the ashes of the beech are rich in phosphate of lime, which it extracts largely from the soil, while those of oak contain very little of this substance, it will be seen in what opposite ways these trees act upon the soils in which they grow.

In planting, it should be always borne in mind that the larger the plantation upon exposed situations, the greater the relative value per acre of the woodland; for the benefits of shelter are as distinctly traceable in the woods themselves as upon the adjoining corn lands and pasturage. In such places narrow belts seldom or never pay for cultivation. When the proprietor's fondness for arable and pasture land causes him to arrest the progress of the planter, and compels the latter to hang his woods in mid-air, the result must be disappointment to both. Allow him to extend his boundaries ever so short a distance into the fertile soil of the valleys, he is armed with a power which will enable him to contend successfully with the storms of autumn and winter and the drought of summer. The vigorous growth of trees around the margins of his plantations will shelter and draw up gradually those upon the more exposed sites, and the whole plantation will be benefited thereby. Upon very thin and poor soils it may sometimes even be necessary to commence planting at the foot, and slowly climb to the summit. This will in general abundantly repay the cost of the experiment; for wherever a crop of pine can be matured, the soil will afterwards carry hardwoods—if not as timber trees, at any rate as remunerative coppice.

The laying out of wood-rides to facilitate clearing, as well as for the convenience of the sportsman, need not be dwelt on here; suffice it to state that while they greatly enhance the value, as well as the beauty of the woodland, they also play an important part in promoting the healthy growth of trees. These rides have been called the lungs of the forest, and as such are very essential to the distribution and free circulation of air, without which healthy vegetation cannot exist. They should, however, be so contrived as not to admit destructive winds.

The boundaries of all plantations should as much as possible be kept out of sight, the perfection of art being its concealment. In woods, as in gardens, it is not necessary that "every valley have a brother," and one half the plantation "just reflect the other." The configuration of the hill or hills, the neighbourhood of the sea, and the requirements of the homestead, the meadows, and the pasturage, must each be considered.

Where there is exposure to violent winds, no tree is better adapted

to such a position than the beech. Its habits of growth, and the peculiar conformation of its branches, which in a well-grown tree present an almost irresistible leverage to the fury of the storm, enable it to flourish luxuriantly where the oak would become a mere starveling, bare and misshapen. The beech is well adapted to chalky soils, and forms an effective screen in many parts of the south and east of England. Its wood also is of considerable value in the arts, and the ashes of its refuse are admirably suited to a corn crop. It also supplies more timber upon a given space than any other hardwood tree.

Though the custom of planting nurses of larch, Scotch fir, spruce, and some other kinds among the hardwoods has become almost universal, yet the instances in which such nurses are efficient for immediate shelter are still rare. Oak and chestnut of 4 or 5 feet in height are entrusted to the care of larch and fir of from 18 inches to 2 feet in length; and though the latter will ultimately go ahead of the hardwoods, their use as nurses will commence only when the mischief is wrought. The sudden exposure from the lines of the nursery to the more open position in the woodland has the effect of hardening the sap vessels of the young trees, and permanently arresting their growth. To remedy the mischief done by such exposure, it is customary to cut back the young oak and chestnut at the end of the second year, by which time their roots have attained sufficient strength to push them rapidly forward. A little consideration would suggest a remedy, by planting the nurses two or three years before the hardwoods, and thus allowing them to attain sufficient strength for the performance of their allotted task.

A mixture of Scotch fir or Austrian pine with the beech and larch upon the outskirts of plantations is generally beneficial, as their foliage affords shelter at a time when the deciduous trees are bare. Care in the selection of trees should be taken by the forester, as different classes require varieties of soil. Thus among oaks the *Quercus pedunculata*, or common British oak, with its leaves upon short petioles, and fruit upon long footstalks, prefers damp soils in plains, and flourishes upon strong clays; while the Durmast oak (*Quercus sessiliflora*) flourishes best upon more hilly ground, provided the soil be moderately loose and damp. This latter species has its leaves upon long stalks, and fruit sessile or stalkless, in clusters of from two to five.

After fixing upon the site and extent, the next consideration is the ultimate object of the plantation,—whether it is intended to be pure coppice, coppice with stores or standards, or high forest only. In either case the thickness of the planting should be regulated by the nature of the soil and the exposure. To plant thick, and thin early

is a maxim which deservest attention. For pure coppice, especially in hop-growing districts, nothing is more valuable than ash, sweet chestnut, maple, red willow, birch, beech, oak, alder, and hazel; these being disposed according to soil and drainage. Now that creosoting of poles is general, the cultivation of the softer woods is more remunerative. Three and a half feet upon the more exposed quarters, and four feet in more favoured spots, will be found good distances for planting. For the second class of plantations the same kinds of trees may be used, a sufficient number being reserved for standards at the time of the first cutting or exploitation.

The periods of cutting will vary from nine to twelve or thirteen years, according to climate and soil. Upon suitable soils plantations of pure larch, ash, or sweet chestnut are highly remunerative, the latter being sometimes sold at from £50 to £60 per acre, the growth of nine or ten years only.

Where it is intended ultimately to grow timber alone, the hard woods may be planted at distances of from 12 to 15 feet, and filled up with nurses of 3½ or 4 feet apart. In this case thinning and pruning must commence early, and continue until the standards only are left, at distances varying from 25 to 40 feet apart, carrying respectively 69 or 27 trees per acre.

To assist the planter in ascertaining the number of trees required per acre at any given distance, it should be remembered that at one foot apart an acre of ground will take 43,560 plants. This number divided by the square of the distance apart in feet will at once afford the desired information: thus, at 5 feet apart, divide 43,560 by the square of 5, or 25, and the result will be 1,742—the number required. At 12 feet apart divide by the square of 12, or 144, which will give a result of 302. As the Scottish acre contains 54,760 superficial feet, and the Irish 70,560, the same process may be applied in calculations for planting in either country.

The sizes as well as distances of plants should be regulated by soil and situation. Upon exposed places with light soils, where the system of planting in slits or notches is practised, two years' seedling larch will be strong enough, and other firs after one year's transplanting. For lower situations and deeper soils allow one more year. Upon the thinner soils trenching before planting would be positively injurious, holing a doubtful advantage, and notching the surest method. Too much moving of the soil would prove fatal to its retention of moisture.

With regard to the distances of plants for pure coppice, it is a well-known fact that when the stools are tolerably close together the shoots start off at once with a straight growth; whereas when planted at greater distances the poles are apt to become twisted and crooked at

the base, and in sharpening for hop-poles the most valuable part for durability has to be sacrificed.

In planting mainly for ornament, whether in parks or elsewhere, trees should be judiciously mixed according to habits of growth and colour of foliage. Groups of various kinds, such as oak, chestnut, Scotch fir, beech, sycamore, plane, and lime, should not end abruptly, but blend one with the other. Most of these, with the exception of the Scotch fir, are very imposing as single trees.

To deepen the shade of valleys or glens, or as a bold contrast to a projecting mass of rock, nothing is more effective than the yew. Though this tree will grow upon nearly all soils, it is best suited to those of a chalky nature. If its growth is slow, it attains a great age, and its matured wood is very valuable.

As a temporary screen in exposed places there is no faster growing tree than *Populus Canadiensis Nova*, which in tolerably moist situations will attain a height of upwards of 20 feet in three years from the time the cutting is put into the ground. From its rapidity of growth it is coming into use in Kent as a "lew" or shelter-screen for hop-gardens.

The Austrian pine, in masses, or in single trees along the margins of wood-sides, has a noble appearance. Where rabbits and hares abound, *Pinus laricio* is tolerably safe. But no ultimate success can be expected by the planter where rabbits are numerous. For a time dressings of various mixtures will keep them off the young trees; but during winters of great severity they will climb the snow-drifts and attack ash, holly, chestnut, poplar, and almost any kind of tree, sometimes completely ringing it.

In planting hedgerow timber, whether for ornament or shelter such trees should be chosen as are of upright habits of growth. Avoid the ash and willow, particularly in the vicinity of closed drains. The oak, sweet chestnut, sycamore, birch, elm, and Norway maple may be advantageously used. By early pruning they may be kept from injuring materially the crops and the hawthorn hedges, and may become highly ornamental as well as useful. Beech is objectionable in this position, as hedges die under it.

(*To be continued.*)

Technics of Forestry.

By J. CHARLES KING.

No. I.

The unlettered craft of the workman, as soon as it finds a written or verbal exposition, becomes at once the technics of his toil. In most crafts the processes are manual and so simple, and the tools few and familiar, that their diversity or similarity are capable of explanation in a brief essay.

The coinage of the word technic will, in future ages, mark as an index point the period of the recognition of the value and dignity of toil.

A modern poet has paid tribute verse to the idea :—

> "He marks an epoch, who on scroll unfurled
> Dares grave men's thoughts, or by his voice proclaim :
> He flings his mandates to a listening world
> That tribute pays by faith, by time, by fame."—"*The Epic of a Day.*"

In remarking on the technics of forestry it would seem that there is but little to say about the handling of an "axe," a "bill," or a "saw," or "winding a withe," "girdling a tree," or "planting a shoot," "grafting," &c. ; and for that very reason it should be said, for the advantage of the young forester, and also for the man of science, who is often stopped short in his exposition of science by his ignorance of the technics of toil, sometimes descending to guesswork to elaborate his views or theories, too often wrongly, as our encyclopædias show in their descriptions of the processes and methods of workmen.

Before explaining the processes and methods adopted by woodwards in forest work, and illustrating their tools and their uses, it may be well to define at once the boundaries between art, science, and technics, which is, perhaps, best done by showing the relation they bear to each other.

Technics are the manual or muscular operations, or methodical procedures, by which workmen do things.

Science is demonstrated knowledge based on unvarying principles in nature, or modes of operation having recognised adoption for estimating and determining results.

Art is the skilful application of things or processes to each other by the rules of science, by which added pleasure is given to the senses.

The flora of nature gives pleasure to the senses, but added pleasure is evolved by the culture, training, and elaboration of tree or flower growths. Science guides by its unerring laws, the same in all ages and in every clime ;—

> "But after all 'tis human senses mark
> Equations and analogies of power,
> And gauge offhand by human instinct's spark
> An age of learning, tested in an hour."

Some of the details of forest work are incidentally referred to in my essays on "How to Select a Farm and Manage it." But the following remarks will be devoted more especially to tools and processes in forestry, and their uses for all descriptions of forest work.

Foresters work more for a future age than most other workmen; with them every stroke is a fact which may divide a century past from a century to come of tree-growth, giving or taking embryo wealth, perchance taste to adorn a landscape. For these reasons foresters require special training in their craft, which by study and energy they may dignify into a science.

The slow development of tree-growth prevents great diversity of experiments on single specimens of growth by a single individual, hence the necessity of working mainly on foregone knowledge and collateral experience. How few foresters live to fall the tree they planted, if of large growth; they can only gather the seed sown by their progenitors; what they did and said are the text-books for our study as our toil and experience will be for our successors; hence the necessity for a chartered School of Forestry under first rate supervision.

The late Earl of Derby was influential in obtaining a charter for a "Fibre Company" some years ago. How much more essential for one on forestry! I affix the word charter advisedly, as it expresses more fully the aim and scope of the institution which would take charge of State forests, and guide the logical course of tree and timber planting, cultivation and preservation in Great Britain and Ireland and also to a great extent in the colonies.

A woodward is a working forester, and generally an agricultural labourer, the affix a "ward" at once marks a grade higher than a "hewer," as it implies the duty of care-taking.

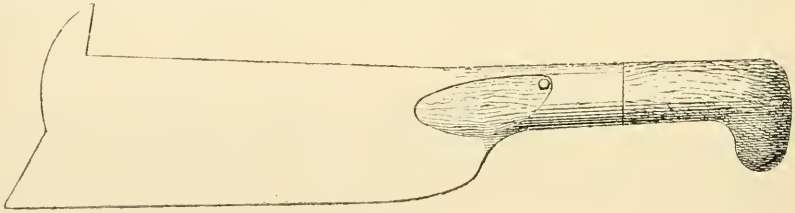
As farm labourers, they rank highest, and are often thatchers, hurdle-makers, and lath-renders as well. Their use of tools of which they are owners, gives them a status above other men who can only offer the use of a pair of willing hands. It may be thought, by those unacquainted with forest work, that an active, intelligent labourer has only to be shown the use of the rough tools, of which we give illustrations, to be able to use them; but they cannot; even with the incentive of the

double and treble pay a woodward earns to stimulate to exertion, aided by the indulgent toleration of bad work by the head forester, a labourer cannot become a woodward without training in youth and experience in age.

The tools are few, but essentially effective for the purpose :— a grass-hook, bill, light axe, heavy axe, hand-saw, fall saw (teeth cutting only one way), cross-cut saw (teeth to cut both ways) beetle, steel wedges, peeling-irons for barking, sleeve or mitten for left hand and arm, rod pole for measuring work done and to be done, pieces of sharpening stone, oil and wad for saws, and saw-set and files.

The youngster is allowed to use the grass-hook, or any bill he can borrow, pick out withes, and clear away a little "brash"; but not having the strength for very hard work, a good deal of his time is devoted to fetching and carrying for the men.

The grass-hook is mostly an old but sharp bagging-hook, *i. e.*, with a set-off or crank of an inch down from the handle to the blade; this



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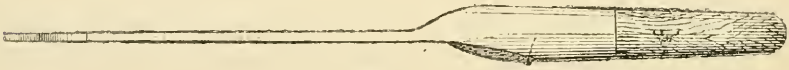

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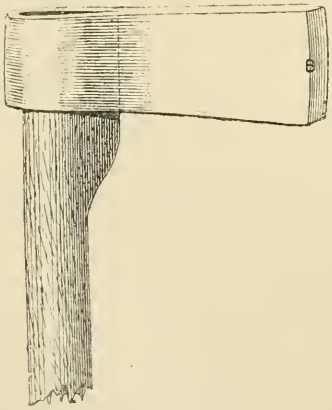


No. 3.

No. 4.

crank carries the handle up from the line of the blade, so that the knuckles of the user are out of the way of the ground and bushes.

Illustration No. 1 is a bill such as is used by bark-peelers.

No. 2 is an edge view of the same, looking at the back.

No. 3 is a heavy falling-axe, part only of handle shown.

No. 4, a view of the same wedged on to the handle, which is of ash, a little over a yard long, and has a clutch-knob at the end the same as to the bill-handle.

The first tool to hand, or always in its sheath at the woodward's side, is the "bill." As you may know a workman by his tools—I don't mean their number or condition, but the shape and make,—so an experienced man can tell the state of a forest almost by looking at the sort of tools the woodward uses; and no better index is needed than the "bill." There are several sorts, but for real forest work one only, of which the annexed illustrations are accurate, is capable of doing work efficiently and thoroughly. Of course they vary in size, according to the age or strength of the user, or the trees it has to be used upon. Generally, the softer the wood the heavier the "bill" should be that has to be used.

For general purposes, hedging, &c., the "bill" is an inch or two longer, more curved at the cutting edge, and thicker at the back edge; which will be described hereafter.

No. 1 has a straight-edged and an angular point, with a spur at the back edge; the angular point is to serve for drawing the long opening cuts in the thin bark of the oak branches. This is done by leaning the left hand on the back of the bill while it is drawn along the branch with the right hand: a round-ended bill would not penetrate deep enough. These bills are about a full eighth of an inch in thickness of blade, and mostly steel throughout. The off-side edge only is ground; if for a left-handed man, the near side must be ground instead.

After grinding, a piece of blue ragstone is used, and sometimes for a finer edge, a piece of Chorley Forest stone is used.

(*To be continued.*)

The School of Forestry in the Escurial in Spain.

By the Rev. J. C. BROWN, LL.D.

In France and in Prussia, in Bavaria and Austria, in Russia, in Finland, and in Sweden, there are Schools of Forestry, having designations indicative of their being such. In the kingdom of Wurtemburg the School of Forestry is combined with a school of agriculture; in the Grand Duchy of Baden the School of Forestry is included in the Polytechnicum or Technological School. In Spain the School of Forestry is such, pure and simple; but it bears the designation *La Escuela Especial de Ingenieros de Montes* (The School of Mountain Engineers). In France not a little has been done by *les Ingénieurs des Ponts et Chaussées* (or the Engineers of Roads and Bridges), in carrying out, in connection with the officers of the Forest Service, the *reboisement* of the mountains, or the replanting of them with trees, &c., with a view to arresting and preventing the destructive consequences and effects of torrents. The designation of the Spanish School of Forestry indicates that something similar to this is the main and the special duty of the corresponding body of engineers in Spain. Their duties relate primarily and specially to the creation rather than to the exploitation of forests. It is located in the old palace of the Escurial. It is under the control of the Minister of Instruction, and it is regulated under a decree issued under date of 24th October, 1870. Under a previous decree, of 23rd October, 1868, the prescribed course of study embraced a period of three years. By that now in force the curriculum has been extended to embrace a period of four years.

In order to gain admittance to the school, the applicant must be accredited by certificates or diplomas of having passed an academic examination in the following subjects,—Spanish grammar, Latin grammar, geography, and the general and detailed history of Spain; and he is admitted after passing, with approval, an examination in the school on the elements of natural history, the elements of the theory of mechanics, descriptive geometry and its application to projections and to perspective, physics, chemistry, lineal, topographical, and landscape drawing, and his knowledge of the French and German languages.

Every year there are issued programmes specifying the subjects on which applicants for admission must be prepared to be examined. According to the programme for the present year, 1877, the preliminary entrance examination through which applicants must pass embraces amongst others the following subjects:—Theory of mechanics: the general principles of statics, and their application to the determination of the centre of gravity; the general principles of dynamics, including inertia, momentum, reaction, vital force, movements of points and movements of bodies under varied conditions, and the establishment of equilibrium. Descriptive geometry, and its application to projections and perspective, embracing points, straight lines, circles, and planes, triangles, polyhedrons, sections and intersections of these, tangents, cylinders, cones, lines of revolution, involution, plane and conic sections, the projection of shadows, and the geometrical laws of perspective. Physics: properties of bodies, gravity, specific gravity, peculiarities of solids, of liquids, capillarity, gases, atmospheric pressure, elastic force of bodies, flotation, and temperature. Acoustics: propagation of sound, and distinctive characters of sounds. Heat: expansion of bodies in a solid, a liquid, and a gaseous state, and operations by which it is effected; hygrometry, and transmission of heat. Optics: propagation of light, photometry, reflection from plane and curved surfaces, refraction and dispersion of rays, structure of the eye, optical instruments, double refraction, and polarization of light. Electricity and magnetism: static electricity, distribution by conductors, measure of electric force, magnetism, dynamic electricity, electro-magnetism, electro-telegraphy, thermo-electric currents, electric induction. Meteorology: thermometrical observations, winds, aqueous phenomena, electric phenomena, luminous phenomena. Chemistry: chemical notation, combining proportions, theory of chemical equivalents, specific heat, atomic theory, metalloids and their more important compounds, other elementary bodies, the more important combinations of hydrogen, combinations of oxygen with other quasi-elements, fluorate of silica, carburetted hydrogen, cyanogen, general properties of metallic and other salts, special study of the more important metals and their compounds. Natural history: distribution of existing bodies in groups and kingdoms, distinctive characteristics of species, of organs, apparatus and functions, mode of studying minerals and determining their production, composition, and importance, crystallography; classification, nomenclature, and chemical properties of minerals. Botany: structure and forms of vegetables, organs of vegetation, roots, stems leaves, with their variation and arrangement, and effects of this on ramification; flowers, inflorescence, calyx, corolla, stamens, pistils, and ovary; fruits, seeds, vegetable physiology, nourishment and growth, reproduction, classification, and specification of properties

common to classes of plants. Zoology: difference between animals and vegetables, animal structure, organography, and physiology; classification proposed by Cuvier and modified by Milne Edwards; characteristics of mammiferæ, with description of the principal families of rodents, of pachydermata, and of ruminants; characteristics of birds, and description of the principal families of gallinaceous, of wading and of web-footed birds; characteristics of fishes, and description of the principal families of soft finned fishes; characteristics of the principal families and the more remarkable genera of the coleoptera, of the orthoptera, hymenoptera, and lepidoptera; and the geographical distribution of animals, with causes influencing this.

On these subjects the candidate for admission is examined before he can enter the school. He is free to pass through these preliminary studies when he pleases, and there are specified works on the several subjects, from which information preparatory to examination may be obtained.

It is stated that in the examination in drawing there will be required manifest facility in copying correctly an order of architecture, or a machine; some model drawing of a landscape in *Les Etudes d'après Nature*, by Calame, and a pen-and-ink representation of mountains, sands, rocks, and arable land, according to the method of Rindavets; and in French and German, correct translations from these languages into Spanish.

Application for admission must be made previously to the 1st of September in any year.

It is not requisite that the applicant should be examined in any one year on all of the subjects embraced in the entrance examination, and he is required to specify those on which he desires to be examined. If he pass any examination with approval, this will be certified, and when he has been examined in all with approval he will be admitted, and enter on the special studies of the school, which embrace the following subjects:—physical geography, land surveying, mensuration of wood, applied mechanics, applied chemistry, applied mineralogy, applied botany, applied zoology, applied geology, laying out of forests, sylviculture, meteorology, and climatology; mountain geography and classification of mountains; forest industries; political economy, with a special reference to its application to forest questions; elements of the administrative direction of forest management; and drawing in its application to the course of study required.

For conducting these studies there are appointed a director, who is head of the school; nine professors, of the body of engineers; two assistants, who must also be engineers; and to these are joined the following subordinates:—A collector, preparer, and conservator of

objects of natural history; an official assistant secretary; an official assistant librarian; two clerks; a steward; a resident in charge of the school forest; a porter; three servitors; necessary warders and sub-warders for the protection of the land and mountains appropriated to the service of the school; and labourers and peasants required for work on the same.

The instruction is given (1) by oral lectures and lessons in drawing by the professors; (2) by written exercises, calculations, and analyses on the subjects embraced by these lectures; (3) by the detailed study of the animals, rocks, plants, and forest products which constitute the collections and adjuncts of the establishment; (4) by the practice of topography, land surveying, the study of natural history and mountains in the field; (5) by excursions to the plantations and mountains.

The school sessions extend, with specified holidays, from the 1st of October of one year to the 31st of May in the year following. Field exercises are included in this session, but according to what may be required in different classes these may be extended over the months of June, July, and August.

The material provisions for study are specified as consisting of the buildings, lands, forests, nurseries, gardens, and their dependencies; appropriated to the school is a meteorological observatory; the furniture of the institution, a library and collections of charts and drawings; a laboratory and cabinet of chemistry, with apparatus and reagents; collections and museums of topography, land surveying, and cabinets of illustrations of natural history, of mountains, of mechanics, and of forest industries; the collection of iron implements employed in the practical working of the school lands or in the study of the pupils; herbaria and collections of plants and of fruits; and in conclusion, the workshops and machinery, with all the iron tools belonging to these, and the equipments and arms of the warders and dependants.

The students do not live in the school. Each is required to lodge his address with the secretary of the school, and to keep him informed of any change of residence made by him. They are required to supply themselves with all text-books, mathematical instruments, writing and drawing implements, and the uniform enjoined upon students; but beyond this I know of no pecuniary charge made upon them, Regular and punctual attendance, studious attention, and respectful and orderly behaviour are enjoined.

Occasional absence, even with consent of the instructor, want of punctuality, inattention, &c., are punished by deductions from the numerical value attached to the attendance required in order to obtain a diploma at the close of the course; disobedience, insubordination, &c., are punished by expulsion or suspension till the decision of the Government is obtained.

Provision is also made for foreigners or others who have studied forest science elsewhere, obtaining the qualification for service in Spain which this school can give.

Of one who is admitted to the school as *alumno externo,* there are required the certificates and entrance examinations required of the others. It is not required of him that he should give attendance on the classes, but he may if he chooses attend all of them, and he may claim to be examined in the several subjects taught in the school, with the following exceptional limitations :—Before being examined in the laying out of forests he must have studied in the school applied mechanics; before being examined in sylviculture he must have studied in the school applied mineralogy, applied botany, applied zoology, and applied geology ; before being examined in the geography and classification of mountains he must have studied in the school meteorology and climatology ; and before being examined in forest industries he must have studied in the school the measurement of wood and applied chemistry.

Lectures are given so far as practicable in the forenoon, and exercises in drawing, in writing, and in cabinet or laboratory studies, and in practices in the field in the afternoon of the day. The students are required to follow the course of study in the order prescribed, and to submit to examinations on these in the years appropriated to them. The results of these examinations are recorded, and at the close of the course the order of merit in which the students stand is determined by these results; and in the diploma given to each student is certified the rank of his attainments.

The examinations take place in the months of June and September, and the drawings, charts, and written exercises must all be executed within the walls of the school.

It may surprise some of your readers if they be informed that the Spanish language is rich in literature relating to forest economy. I have had sent to me a work by Don José Jordana y Morero, Ingienero de Montes, entitled *Apuntes Bibliographic Forestale,* which is a *catalogue raisonné* of 1,126 printed books and MSS., &c., in Spanish, on subjects connected with forest science.

The Forests of Russia and their Products.

By JAMES RUSHFORTH.

(*Continued from page* 335.)

Let us now see what the Russians can do in the way of working up their wood. The manufacturing industry of Russia is carried on in two different ways,—in the regular established manufactories and workshops, and in the large villages called *Selas*, which are very numerous throughout the empire. This latter kind of industry has probably existed from time immemorial, and had its origin in the long winter which follows the cessation of work in the field, during which the artisan peasant exercised his ingenuity in particular crafts which were found suitable to the locality in which he lived. Thus in the forest districts, various articles of wood are manufactured on an extensive scale.

Although Russia is rich in iron mines the production of iron is small, and is not over 300,000 tons annually, the consumption of iron per head of the population being not more than 10 lbs. yearly. Numerous articles which with us are made of iron or earthenware are made of wood in Russia—from enormous bowls, in which a man can float, to wooden spoons, which are made in millions. The bowls which we see in the grocers' shops in Russia, as well as the above-named articles, are made of the lime tree, painted and lacquered, principally in the villages of the government of Nijni-Novgorod. The common Russian spade is made of wood merely tipped with iron; and there are wooden pumps, wooden chimneys, &c. Russia is not only a country of forests, but it may be regarded as a collection of extensive wooden villages, not towns properly speaking, for with the exception of the capitals, and some of the larger provincial towns wooden houses prevail everywhere. They are seldom found to be less comfortable or convenient than stone houses, as they are often constructed with great taste and with every possible convenience, though they naturally differ materially from the peasant village or *izla*.

The izla, or dwelling of the Russian peasant, with its usual surroundings, presents, it is supposed, the same appearance as it did 500, or even perhaps 1,000 years ago. The izla is made of logs which are deeply dovetailed together at the ends. The axe is almost the only instrument used in its construction. It should be

remarked that with the axe the Russian carpenter does almost everything; it answers the purpose of saw, hammer, and plane. The interior of the izla presents two compartments, the principal dwelling-room and the *kleit*, or summer chamber, which are joined together under the same roof by a passage called the *sanec*. The kleit is usually built higher than the dwelling-room, which admits of sufficient space underneath for keeping a cow or two &c. The most prominent object in this chamber is the *paysch*, or Russian stove, on top of which the family sleep in the winter. We may here mention an article of enormous composition, viz., boxes, some of them as large as clothes chests, bound with iron straps or bands.

They are made of pine or fir, and have sometimes a looking-glass inside the lid. They are made principally in the villages of the governments of Perm, Viatka, Nijni-Novgorod, and Vladimir, and are sold mostly at the fair of Nijni-Novgorod, one fitting exactly into the other in eight different sizes.

Another article which is manufactured in enormous quantities by the peasantry in the villages, and for which wood is employed, are the *ikonas*, or "holy pictures." There is not a peasant's izla without one stuck up in the corner of the room. Some idea may be formed of the great demand for these pictures when we consider the enormous peasant population of Russia. One of the principal centres of the manufacture of these ikonas is the village of Kholui in the Viasnikoff district of the province of Vladimir. The pictures are painted on boards of lime, alder, aspen, pine, and fir, and a few on cypress wood, and are brought over the Volga to the village about Christmas-time to the extent of from 40 to 200 sledge-loads per week. The artist-peasant of Kholui works on these "holy pictures" from early infancy to old age; he uses his brush like a machine without the least artistic taste, consequently his products are of the roughest description, for he has to work hard and very rapidly to earn anything like a livelihood. Some of these "artists" are able to paint the drapery of 600 ikonas per week, others to finish the 600 heads of the same in the same short space of time. The price of these fixtures is very low, something like 6s. per 100. In the village of Kholui alone from a million to a million and a half of these ikonas are manufactured yearly. They are brought up by the *ofencs*, or itinerant wholesale dealers, in hundreds of cart-loads, and are carried by them for sale to every corner of the vast Russian empire.

Wood is extensively employed for the construction of rafts, upon which on some rivers produce is floated down stream and of the so-called *barkas*. This is also a rustic industry. The *barka* is a kind of

barge of very primitive construction, and has probably preserved the same form and general arrangement which characterized it a thousand years ago. These vessels are of enormous size, flat-bottomed, very little labour, and that of the roughest description, being employed in their construction. Some of them are able to carry a cargo of 2,000 tons, while drawing very little water. The so-called *belianas* have sometimes a capacity equal to that of a ship of the line, and are particularly adapted for carrying the produce of the country down the rivers to the seaports. The basis, or keel, of these barges is the large trunk of the pine, of which the strongest side-branches are left, and serve as ribs to the boat; the planks that cover the ribs are smashed merely with the axe, and made fast with strong wooden pins about three quarters of an inch in diameter and 7 in. long, this imparts elasticity to the body of the vessel, a quality which is found essential in the intricate navigation of the Russian rivers. The timber consumed in the construction of these rude specimens of naval architecture is something enormous, as they are only meant to serve for one voyage down the Volga, or the other numerous rivers of Russia. Arriving at their destination, and after unloading the cargo, these barges are sold for a mere song, something like £10 each, and are broken up; the ribs being sawn up for firewood, and the boards used in the construction of sheds, outhouses, &c.

We now pass from the rural indications to those performed by *bona fide* craftsmen in regularly conducted workshops, which are numerously established in the capitals and most of the provincial towns throughout the empire. It should be borne in mind that the Russian common man is a very great adept at imitation, and exceedingly dexterous in handicrafts, and does wonderfully well under a strict foreign, particularly German * master. The workers in wood manufacture everything that is made in Western Europe, there are therefore carpenters, joiners, cabinet-makers, &c., who work for wages; piece-work in these trades is not known. The articles of wood exhibited at the last St. Petersburg exhibition were unfortunately few, comparatively speaking, when we consider that that material is a staple commodity of Russia. There were only three exhibitions of coopers' work, two from St. Petersburg, and one, Anders Lind, of Abo, in Finland, whose casks, barrels, &c., were acknowledged to be the best. Mr. Beliayeff, of St. Petersburg, and Messrs. Armsted, Mitchell, and Co., of Riga, exhibited some fine specimens of house fittings manufactured by machinery. Specimens of parquette flooring were also shown, the work of which was pronounced to be very satisfactory and the prices moderate. Parquette for rich and elaborate

* Nearly all the best joinery and cabinet-making establishments in the capitals belong to Germans.

dwellings was more particularly noteworthy, the design being in rosettes of mosaic of different foreign woods. It should be observed that the use of machinery in the manufacture of articles of wood is coming more and more into vogue in Russia, which serves both to improve and cheapen the goods.

It is strange that Russia has not yet, with all its forest riches, endeavoured to compete with Norway in the export of all kinds of machine-made carpentry, &c.

Although there were a good many exhibitions of furniture from St. Petersburg workshops, it cannot be said that they faithfully represented the furniture trade of the capital.

There were shown only very rich and expensive specimens ; middle-class strong and useful articles at moderate prices were wanting. Then in the furniture which was displayed the strength of work as an appendage to expensive articles was quite a secondary consideration, and the attention of the jurors was devoted mainly to the artistic side, the form, ornamentation, carving, &c. In this respect it may be said that the best St. Petersburg firms have made marked progress—they have at last become firmly convinced that routine and a slavish repetition of old patterns and designs are incompatible with really first-rate production ; they are now supplied with designs by first-rate artists, academicians of St. Petersburg.

As a novelty at the exhibition in useful furniture may be noticed chairs manufactured of ash, on the principle of the Austrian chairs, which are of beech, and imported in large quantities into Russia. The ready-made furniture, which is sold in the markets of the capitals, appears at first sight cheap, but it generally turns out veritable rubbish, and what with the heat of the sun in the summer, and the hot rooms in the winter, it will hold together but a very short time. Among the articles manufactured in factories in Russia may be mentioned lucifer matches ; they are produced with every improvement in Finland, in the capital, at Moscow, and besides a large demand for them in the country, they are largely exported for foreign consumption.

Whittlewood Forest.

The Forest of Whittlewood is situated on the borders of the counties of Northampton, Oxford, and Buckingham, and comprehends within its ancient bounds a considerable territory extending into those three counties. This forest, as well as that of Salcey, is part of the honour of Grafton, and there were various perambulations made of it in the reigns of Henry III. and Edward I. Another was made during the reign of Charles I., extending the bounds of it far beyond the former limits, but the Act of 16th, Charles I., restricted it again to the old limits of James I. Indeed, these arbitrary extensions of forests beyond the old limits, and their subsequent confinement to such area, may be taken as indicative of the temper both of king and parliament, and which led to the civil war by an aggregate of such encroachments on the liberty of the subject and a substitution of the royal will. The coppices were cut in rotation at twenty-one years growth; and after being enclosed for nine years from the time of each cutting of the underwood, then thrown open to the deer and cattle for the remaining twelve years, excepting Shrobb Walk, which was not subjected to any rights of common. The cattle allowed to depasture in the forest were horned cattle and horses only; no sheep or swine were admitted. The officers were a lord warden, or master forester a lieutenant or deputy-warden, two verderers, a woodward, a purlieu ranger, five keepers, and six page keepers, besides the surveyor general of the woods and forests.

In 1608 the number and value of the trees in the Forest of Whittlewood is stated to be as follows:—Oak timber trees 50,046, value £25,755; decaying trees 360, value £123 6s. 8d. The number of loads of timber is not stated in this survey, but the account of the value of the trees enables us in some degree to supply that deficit. The common price of oak timber at that period was about 10s. per load. The 50,046 trees, then, valued at £25,755, must have contained, one with another, about a load of timber each, and making reasonable allowances for the tops and branches of the trees, there must have been in the forest from 40,000 to 50,000 loads of timber, girt price, or from 60,000 to 75,000 loads, square measure.

The quantity of naval timber felled from 1772 to 1786, inclusive

was 3,158 loads, the produce of which, with the bark and offal wood, amounted to	£8,986	17	4
Fees, poundages, and expenses	1,338	8	3
Clear produce of navy timber to that time ...	£7,648	9	1

From 1786 to 1790 navy timber was cut as follows:—2,304 trees, 2,572 loads, and 19 feet, square measure, which, at the then customary measure of £1 18s. per load, together with the tops, bark, &c. amounted to £7,111 16 4

2,022 dotard and decayed oaks, and 331 ash trees sold for payment of officers' salaries ...	1,437	14	10
	8,549	11	2
Less expenses, salaries, &c.	2,496	1	0
Clear produce since 1786	£6,053	10	2
Ditto of navy timber, 1772 to 1786	7,648	9	1
	£13,701	19	3
Less for expenses, salaries, &c.	1,353	1	4½
	£12,348	17	10½

And this sum shews the clear produce to the Crown since the forest was in the hands of the Grafton family, being eighty-five years, at about an average of about £145 5s. 7d. a year.

In 1783 there were growing in this forest, of trees 30 feet and upwards, yielding navy timber, 5,211, measuring 7,230 loads, square measure; and of dotard, decayed, &c., 502, containing 569 loads, square measure. By the same survey it appears that there were 18,617 trees in the forest constantly lopped for the browse of the deer, viz., 6,335 oaks, computed to contain 8,907 loads of timber, square measure, and 12,282 ash trees, containing 3,512 loads; so that the number and quantity of the browsed oaks was greater than that reported to be fit for the navy, of which the number in the coppices was not quite more than three trees to every two acres of land. Between the years 1772 and 1783 there had been felled for the navy 1,461 trees, producing 1,335 loads. If these be added to the trees growing in the coppices at the time of the survey, the number would be still less than two trees to every acre; and if the browse oaks be taken into computation, the whole number of the trees of thirty feet and upwards would be little more than three trees to an acre.

The decay of this forest is attributed to a divided management, part being Crown property and part granted to the Dukes of Grafton,

against which latter no complaint can be made. But against the Crown officials of those days the same remarks as to Salcey Forest would apply here, and it is needless to go over the same ground again. Given a forest to look after and preserve for the national interests, and the problem was how to get the most out of it for themselves in addition to their legitimate salaries. In this instance the trees were left on the Crown lands to grow just as they pleased, no care being taken to plant in vacant places or to thin out the trees. In some coppices there was little or no succession of young oaks, and in others they stood as thick as possible, and were left to take their chance of existence anyhow. The history of this forest is a little brighter than that of others, as in this case the grantee seems to have done his duty at the periods above mentioned, and also done his best to protect timber trees which others were paid to protect, viz., those belonging to the Crown. Although the supply of British oak is no longer of material consequence to our navy or building trade, the causes of the waste undergone by our native woods, read us lessons which will be useful in the future, even if ornamental trees were our only aim. In that case, too, we may even learn much from the failures of others; but as a profitable market can be found in this country for home forest products, there is an additional reason why the science of forestry should be more understood.

Preserving Fence-posts.

By D. SYM SCOTT, Forester, Ballinacourte, Tipperary.

Theoretically the season of the year, even the age of the moon, in which timber trees ought to be felled, has occasioned widely divergent opinions. *Practically*, however, the question is easily settled, and the period usually chosen well defined. Objections to felling timber during the summer months are based on the notion that trees being then in an active state of growth contain a greater preponderance of sap, which renders the wood when used extremely liable to rot; but when felled in winter, when comparatively inert, the timber resists decay or rot more effectually. True, a tree apparently has a larger proportion of sap when in its full vigour of growth, but the dead weight is much lighter during the same period, as the sap is at that time more rarefied. Any forester can test the validity of my theory by taking each month a number of pieces of the same kind, but from different trees, each piece to be of equal size, which are to be weighed, and the weights of each month carefully registered. This to continue over the year. To make the experiment so as to insure the greatest accuracy, the test ought to extend to more than one kind of tree, and be carried on in different plantations, of course noticing the weight of each specimen separately. From my own experiments I found timber cut in June and July to be much lighter than that cut in December and January. I attribute this difference in the weight wholly to the consistency of the sap, and that much of the sap leaves the body of the tree when making leaves, new wood, and bark. Hard wood contains about 40 per cent., Coniferæ 45 per cent. of sap, and the object of seasoning timber is to get rid of this moisture. There are two methods employed for this purpose, the natural and the artificial. The natural, as with everything else, is the simplest and by far the best. By this method the sap is allowed to evaporate of its own accord. Timber cannot be kept too much exposed to the free action of pure air, as churches and open-roofed houses bear witness; but as the natural system of seasoning encroaches considerably on our time and patience, it is generally expedient that we should give it some assistance. This can be done without detracting in any way from its merits.

Timber should be well seasoned before being used in buildings; but proprietors, as a rule, very much neglect this important point,

the neglect of which has a deteriorating effect on the value of home-grown timber. My own experience in supplying home-grown timber for all sorts of rural erections has been very extensive, and I have invariably found the raw material used without the least consideration being given to its seasoning. Wood encased in a coating of plaster, or sub-planted in a mothery atmosphere, such as surrounds green timber giving off its gases, must soon fall a victim to internal decay through the fermentation of the moisture it contains.

The proper seasoning of timber before being used in any sort of structure is far more important than the season of the year it is felled in, kind of timber used, or preventatives employed. There are paints, washes, and heterogeneous steeps recommended for preserving posts, but each are comparatively costly, and only partially successful. One great objection to the application of solutions externally rests on the fact that the sap being confined accelerates decomposition in the interior. Most foresters must have observed this. What I would recommend with fencing posts is, the materials, when felled, to be directly sawn into posts and stored under sheds thoroughly ventilated, where they will remain at least a year exposed to "sun and wind." The neck or part between wind and water of each post should be slowly charred over a strong fire—slowly, because our principal means heating the timber thoroughly to the heart, so as to extract any moisture which may be still lodged at the centre, and hardening a crust on the surface of the posts. Afterwards, to prevent the posts absorbing water, they should be well coated with coal tar, having its acid destroyed with fresh quicklime. The tar should be thoroughly boiled to evaporate all watery matter, and applied boiling hot. A large tank holding the posts set on end, and filled with the scalding tar from a boiler, answers the purpose very well. Of course the upper half of the posts can be painted when placed *in situ.* I am fully convinced coal tar, properly applied to thoroughly seasoned timber, is far more effectual in preserving posts than creosoting poisoning, kyanising, or all the paraphernalia of iron prongs, sheet-iron wrappers (an American invention), &c., &c. One great recommendation in favour of the above process, is that it requires no skilled labour, and the cost is a mere trifle.

Large Yew Tree—Large Walnut Trees—Canadian Maple.

By THOMAS HOGG, Forester, Hampton Court, Leominster.

In the *Gardener's Chronicle* of October 19th, 1844, I find the following paragraph descriptive of a large yew tree:—"There is in the churchyard, at the village of Gresford, Denbighshire, a yew tree which measures 30 feet in girth at the height of 4 feet from the base. The branches are in themselves large trees, and shade the ground to a great extent. It must be of incalculable antiquity, and it is not yet in a state of decay, though it has for centuries perhaps attained its maturity. Other yew trees in the same place, which were planted (as the parish register records) in the year 1727, are on an average in girth, somewhat more than 4 feet."

Assuming the above to be a fair measurement, it would appear to be still larger than the one at Longleat. However, a few more particulars would be interesting; such as the girth at the base, and at 1 foot, from the base, its spread of branches, height and general appearance, compared with the particulars given 33 years ago. Perhaps some of your Denbighshire readers would kindly furnish the desired information.

There are on this estate some fine walnut trees, the largest girthing at 1 foot from the ground 23 feet 5 inches, and at 5 feet up 16 feet 5 inches. At the height of 11 feet a large bough diverges from each side, measuring respectively 8 feet 7 inches and 7 feet 4 inches, 3 feet from the junction with the bole. Above these boughs, and at a height of 12 feet, the girth is 13 feet 10 inches, and the spread of branches is 100 feet, and the height 70 feet.

The next largest grows about 17 yards from the above, and measures at 1 foot from base 21 feet 11 inches, and at the height of 5 feet, the girth is 15 feet 6 inches. This, although not measuring so much, is a more handsome tree, carrying its girth without much taper to the height of 22 feet, where it diverges into two large boughs which form the head of the tree. The entire height is 80 feet, and spread of branches 73 feet, while the cubic contents of the trunk alone are considerably in excess of 200 feet.

I may mention a third tree which was blown down last winter,

which at the height of 6 feet measured 12 feet in girth. The fruit this year is rather a meagre crop, but I have noticed one remarkable exception—also a large tree—where the nuts seemed almost as plentiful as the leaves.

Some short distance from the above-mentioned walnut trees grows a fine park specimen of the Canadian maple, which at 1 foot from the base measures in girth 15 feet 1 inch, and at 5 feet, 11 feet 5 inches, with a spread of branches of 92 feet, while the entire height is about 65 feet. The remarkable feature of this tree is the different tinge the leaves assume during the spring, summer, and autumn; in spring being pale buff-coloured; in summer, a bright green; while at the present time about half of the foliage is a bright copper colour, while the other half retain their summer green. This is the only specimen of the Canadian maple that I have met with; can any of your readers say whether it is planted to any extent in this country? if so, where good specimens are to be found, if any of the timber has been used from this variety, with any other particulars of which they may be in possession.

Hints for Planters.

By D. SYM SCOTT, Forester, Ballinacourte, Tipperary.

As planting forest trees will now be general, the following concise remarks on the work may prove instructive, and assist those about to engage in the operation.

The ground ought to be securely enclosed with a good ring fence.

Draining should be finished some time before planting begins, so that the ground has time to "drip." It should be remembered that the necessity for draining arises from water rising to the surface in springs, or, from the flatness of the ground, it is flooded with water oozing out from higher land, and also from the retentive quality of the subsoil a superabundance of water is located in the stratum immediately beneath the surface. Stagnant water is extremely injurious to trees, and draining should never be neglected.

Clearing brush and other obstacles to planting may be done any time previously to the time of planting, but moorland subject to rank heath should always be burned some years before, so that a fine young heathy swarth covers the surface, which affords valuable shelter to small plants.

The forester should ascertain as far as practicable the nature of the soil, subsoil, and if possible the rocky formation, to enable him to distribute his plants judiciously over the ground, giving each individual its *locale* subsidiary with correct arbori-chemical principles. It is further necessary to be thoroughly conversant with the situation, to allot such plants suitable for exposed aspects their proper place, that as the trees grow up they may be beneficial.

The next consideration is the number of the various kinds of plants to form a mixed plantation, and also their size. Having examined the nature of the soil and its surface herbage, also having decided on the tree intended to form the permanent crop, these will give the best guide to go by. The hard wood need never be planted closer than 24 or 30 ft. apart.

Several kinds of planting-irons (tools) are recommended, but a common Scotch spade (the spade universally in use in Scotland is greatly superior to that in England or Ireland) is the best adapted for all practical purposes. In removing plants from the nursery row great care should be taken not to cause root fracture, more especially with the resinous tribe.

Pit planting is very common, but every variety of pitting has some forcible objection to its use. The loosened earth admits of a greater

evaporation in dry weather, and absorbs too much moisture in winter, and, being a slow process, increases the cost of planting very considerably.

Slitting or notching is certainly the best system of planting. It commends itself by being the most expeditious. There are four kinds of notches, all well adapted to varying circumstances: the T (tee) form is very answerable in stiff ground; the L (ell) for small plants; the H (aitch) for a tough surface and large-rooted plants; and the + (cross) for deep surface and large plants.

It is advisable to pare off the surface before putting down the tree; to do this entails very little extra labour. The planter stoops low, and with a smart horizontal swoop of his spade pares off a thin scraw, and exposes the fresh soil beneath.

In making the notch the operator strikes his spade into the ground perfectly perpendicular and as deep as possible, and by again striking across the first slit a notch is made similar to one of the letters shown above, which, by bending down the handle, is sufficiently opened to receive the plant. If the incision is well made, a smart blow with the heel on each side of the plant is all that is required to firm it in the ground. Great care should be taken to see that the roots are all well under the sod and the plant straight. Much depends on the first cut. An expert spadesman amalgamates the operation of paring off a scraw with the making of the notch, and will, with a boy holding the plants, put in from 1,000 to 1,500 plants per day of ten hours.

Planters should be arranged into squads of 20 or 30 spadesmen, with one boy or girl to attend two men, and one or two stronger boys carrying and supplying the planters with plants from the "stock," "sheugh," or "bed;" the whole gang to be under one foreman, whose duty is to superintend the work and see it properly performed.

On laying the men out for the work the most experienced hands should be placed at each side to act as leaders. The squad should work from side to side.

Commencing in the morning at the fence, the leading man after putting in his plant moves off 8 ft., the second spade putting his plant between the leader's two, but 4 ft. behind, and each succeeding man follows inserting his plant between the preceding man's two, until the limits of the enclosure is reached, when the foreman gives the order "reverse," and each man falls back one space, puts in a plant, and without the least confusion as to places makes the spade once the rear now the leader on the return journey.

By this system the foreman is able to detect the smallest irregularity, and by moving backwards and forwards can see every plant put into its place.

Preparing Ground for Planting.

By LEWIS BAYNE, Forester, Kinmel Park.

In most kinds of soils it is useful, and in many cases it is necessary to prepare ground intended to be planted by draining, trenching, ploughing, or picking, according to circumstances, in order to insure success. Where the ground is naturally dry, light, and friable, such preliminary operations may be dispensed with; and, indeed, farther loosening or draining may, in certain circumstances, be detrimental rather than favourable to the plants. But where the soil is stiff, damp, and hard, something ought to be done in the way of preparation, if at all practicable and not too expensive, before the plants are committed to the soil. If this is not done the likelihood is that numbers of the plants will die out, and require to be renewed, while those that do survive will be so long in taking proper root, that some years may elapse before any appreciable progress is made. In this way the ultimate actual loss is often much more than the original cost of all the preliminary preparations necessary, and the result is almost always unsatisfactory when several years' growth has been virtually lost. In the case of high-lying rough ground, however, and on steep hill-sides, and especially where large tracks of such ground are intended for planting, trenching, or ploughing, is often quite impracticable, and preparation in this way would, though practicable, frequently cost too much to admit of its being carried out. But in such circumstances where the soil is stiff and heavy, or rests on a crust or pan at no great depth, even picking and loosening the soil at the places where the different plants are to be inserted will greatly increase the chances of their taking root and thriving. Such a preparation would not add much to the original cost, and the ultimate saving in labour, plants, and time would probably be considerable.

It will thus be seen that the special circumstances of each case require to be studied and decided upon. Deep ploughing, or ploughing and subsoiling, are means that may be resorted to with advantage in many varieties of soil, and where the planting is to be on a moderate scale. The advantage to be thereby gained will appear not only in the saving of plants and labour, but also in securing the after growth of the young trees. If the ground is ploughed and loosened to a depth of fifteen or eighteen inches, and

well harrowed or grubbed afterwards, plants will soon take to their new position, and make more vigorous growths for several years, than if they were planted in unploughed ground. When land is to be planted which has been for many years under cultivation by the plough, the preliminary preparation should be to a greater depth than the previous ploughing for farm crops. In some parts of Scotland ploughing for planting is performed by oxen instead of horses when the ground is very rough and stony, or where whin or other roots are to be contended with. They are considered not only more powerful, but much steadier in draught than horses, and from their steady pull they are not so likely to break the gears in rough work.

Trenching is undoubtedly the most permanent and best preparation for young trees and shrubs, but, on the other hand, it is the most expensive, and is accordingly less frequently had recourse to than ploughing. It is generally only adopted in connection with ornamental planting in parks and pleasure-grounds, or elsewhere on a limited scale. It is also resorted to where a crop of trees have been recently cut down, and the old stumps and roots require to be cleared, and ploughing is impracticable. Where the ground is of a stiff nature, it should be trenched as a rule to about two feet deep, and the top spit or good surface soil should always be well kept up on the breast or surface of the trenched ground, so as to secure good soil to insert the roots of the young plants into.

Draining of young plantations is a course of preparation that cannot safely be dispensed with. The want of sufficient draining is the cause of many failures, both in newly planted trees and in trees of considerable age. Thorough draining not only dries the ground, but has the beneficial effect of cleansing and pulverizing the soil through the action of the rains and atmosphere, and the better the ground has been prepared, whether by ploughing or trenching, the sooner and more surely will the drains have a beneficial effect upon the soil.

Protecting River-Sides.

I AM glad to see this subject introduced, as on many estates and even this one, the protection of river sides forms a heavy item in the shape of expenditure, and it may not be out of place for me to give my own experience in such matters. This river, as it is called in Gaelic the "Black Water," is subject at all times to overflow its banks, often doing great damage. It is nothing uncommon after a *spate* to see haycocks, sheep, and logs of timber sweeping past with irresistible force and carried out to sea; boats sometimes torn from their moorings, and left high and dry, and many other things swept completely away by the river overflowing its banks. Such was the scene witnessed not many days ago, and it may be easily imagined that considerable damage was done. True, very considerable damage was done, and the nature of the injury was perfectly well understood, but the question at issue was, What was the best cure? having had a staff of men employed piling the banks all summer, embracing every opportunity to get on with the work when the water was low enough to allow it. At the place where the works have been going on the water is from 8 to 10 feet deep, the bed of the river in some places being gravel, in others stiff tenacious clay. The piles used for the work were alder, and were driven into the bank with a heavy mallet, giving them a gentle slope back from the water: a large pointed crowbar was employed to bore a hole for the point of the pile to prevent it splitting. This finished, a rail of wood was nailed along the piles about 3 in. from the top, also when the river subsided to about its lowest another rail of the same dimensions was securely nailed at the level of the water. After this we had rough heather securely packed in at the back of the piles down to the very bottom, and rising to near the surface. This done, the earth was then firmly packed in, the banks all smoothed off with as much slope as could be got with safety, and the whole finished over with a tough old turf, or *divot*.

If sown with grass seeds within water-mark, and the grass has not had time to form a greensward, the first spate carries everything away with it, and even, although a sward has been formed, there is not that toughness in it there is in a good *divot*, consequently the

water is more liable to make an inroad. Heather or spruce branches do very well to put behind the piles, and with alder wood for piles, the work will, if properly done, stand a lifetime, and resist a considerable force of water. I may say that we piled a portion of the same river last summer, and after being thoroughly finished in the way described many of the piles are now sending out young growths. Tree roots, I am afraid, under any circumstances would never stand; besides, they would greatly interfere with the angler; and as for causewaying those banks with stones, the cost would far exceed the profit. No doubt slips of willow or poplar are the best things for keeping the banks of rivers intact, provided they be attended to; but as this is a fishing river no such thing can be allowed.

It is no uncommon thing during winter to see this river frozen back for a mile from a point where it enters the woods between perpendicular rocks, where it is spanned by an arch, the height of which is said to be 65 ft. from the parapet wall to the water. The river is a little sluggish here in its flow, and the ice gets jammed between the rocks, thereby damming the whole flood back till it is sometimes one frozen mass for a mile above. After the freshets the ice comes sweeping down, cutting the banks like a knife in many places. But piling as already described is, I find, the best way of resisting the force of either ice or volume of water. No given slope can be laid down, as in many places none can be got, but, where practicable, we begin at the water's edge, and carry the slope well back, finishing with a smooth surface to prevent the water getting hold, and allowing it to run smoothly along.

ANCORA IMPARO.

Betula (Birch).

THIS is a true hardy mountaineer, loving the rugged mountain side and luxuriating in the wild savage glens of the cold north. It is the last *tree* seen on approaching that hitherto inaccessible spot, the North Pole, disappearing entirely at the 70th parallel.

The ancient Caledonians made canoes of birch branches and bark, covering the outside with skins. From birch they made every imaginable kind of implement and vessel. The writer has seen in the remote parts of the Highlands, cottages in which every utensil was made of birch, all being cut out of the solid timber in the most primitive fashion. Fancy, if ye can, ye *élite* of the modern tea-drinking world, your cups and saucers composed of wood! Yet such was once the fashion, and our glorious ancestors' "punch-bowl" and "bicker" were made of such primitive material. In some parts of Inverness-shire the sap is collected in early spring, when it flows freely, and brewed into a delicious beverage, which is believed to be an effectual antidote for consumption. It is recorded that during the years 272—300, and 310, years of great famine, the inhabitants of Britain were compelled to eat birch bark. In Sweden it has been used to mix with corn for food. In Russia and Poland this tree enters largely into the constructive arts, from the fittings and furnishings of the palace to the manufacture of the tobacco pipe. Russian birch emits a very sweet perfume. Numa, who lived 700 years B.C., wrote on bark, and the book lay 400 years in his tomb. Of the varieties the weeping *Betula pendula* is the most graceful. Near Kingachie, Strathspey, N.B., stands a beautiful specimen of the tufted, or horsetail weeping birch, from which the writer has cut a tuft of drooping spray, 12 feet in length. This particular tree is mentioned here, as in all our peregrinations we never saw its equal. The Scotch bards appear to have all been greatly enamoured with the birch, rendering it famous in song and story. The "Birks of Aberfeldy" are immortalized by Burns, but to-day the enthusiastic sojourner will look long and in vain for the "fragrant spreading boughs" which adorned the Falls of Moness in the poet's time. In one particular this tree stands supremely forward in our vivid recollection, and most schoolboys will acquiesce in the parenthesis, when reminded of its formidable appearance when wielded ominously by a stalwart rural pedagogue. —*Jottings from Lon. Fitt's Scrap-book.*

Gossip about the Yew.

STATUTES were passed by many of the early kings of Britain forbidding the exportation of yew wood, and obliging all Venetian and other carrying ships to import ten bow staves with every butt of Malmsey or other wine; and, by the 5th of Edward IV., every Englishman dwelling in Ireland was expressly ordered to have an English bow of his own height, made of yew, wych hazel, ash, or awburn, which last is supposed to have been laburnum. The last statute that appears in the books respecting the use of yews for bows is the 13th of Elizabeth, c. 14, which directs that bow staves shall be imported into England from the Hanse Towns and other places. The custom of planting the yew in churchyards has never been satisfactorily explained. Sir Thomas Browne conjectures, from its perennial verdure, it was used as an emblem of the resurrection. He observes further that the Christian custom of decking the coffin with bay is a most elegant emblem, it being asserted that this tree, when seemingly dead, will revive from the root, and its dry leaves resume their wonted verdure! The yew is called by Shakespeare, in "Richard II.," *the double* fatal tree, because the leaves are poisonous, and the wood is employed for instruments of death. The most probable reason, however, for planting the yew in churchyards consisted of protecting the edifices from wind, and bow-making, whilst being in an enclosed place, the cattle were kept from grazing on the poisonous leaves. Evelyn considers that they were planted in churchyards for no other purpose than providing palms for Palm Sunday, which he thinks were no other but the branches of yew trees. A writer in the *Gentleman's Magazine* for 1780 dislikes all the reasons assigned, and maintains that they were so planted on account of their gloomy appearance and their noxious quality; the first intended to add solemnity to the consecrated ground, the other to preserve it from the ravages of cattle. To countenance his first reason he quotes Dryden, who calls the yew "*the* mourner yew;" and to make it still more fitting for the place, adds the magic use which Shakespeare makes of it in "Macbeth,"—

> "Liver of blaspheming Jew,
> Gall of goat and slips of yew,
> Silvered in the moon's eclipse."

He adds that the great dramatist's opinion of its noxious properties is evident from Hecate's answer to the aërial spirit,—

> "With new-fallen dew,
> From *churchyard yew*,
> I will but 'noint,
> And then I'll mount."

The branches of the cypress and the yew were, in ancient Greece and Rome, the usual signals to denote a house of mourning, and hence some have contended that this custom took its rise from pagan superstition, and that it is as old as the conquest of Britain by Julius Cæsar. In Sir John Sinclair's statistical account of Scotland, parish of Fortingal, in Perthshire, it is stated, "Among our curiosities may be reckoned a yew tree in the churchyard of Fortingal, 52 ft. round." In Dunscore there once stood in the churchyard a large yew tree, much decayed. Three men could stand in it. In Lord Hopetoun's garden, at Armiston, stood a yew which covered about the twentieth part of an English acre. Two yew trees at Ballikinrain are mentioned by the same author as covering an area of eighteen yards in diameter; and one in the parish of Kippen covering by its lower branches a circle of 140 feet in circumference. In Poole's "English Parnassus" the yew has the epithets of "warlick, dismal, fatal, mortal, venomous, unhappy, verdant, deadly, dreadful," annexed to it. Chaucer calls it the "shooter ewe." In Herrick's "Hesperides" we read,—

> "An' look, what smallage, nightshade, cypress, *yew*,
> Unto the shades have been, or now are due,
> Here I devote."

But the yew is so frequently mentioned by poets that it is impossible to give more quotations. Loudon enumerates the following yew trees in England. Those of Fountains Abbey, seven in number, sheltered the founder of the abbey and his monks. A portrait of one of these celebrated trees is given by Strutt, and described as being 50 feet in height, and supposing it to have existed, and been a large tree previously to 1132, it must be upwards (in 1837) of 800 years old.

The Tytherley yews are above 500 years old; the largest 28 feet high, diameter of the trunk 3 feet 6 inches, and the head 50 feet. There is mentioned as being in the same wood an avenue of 162 yew trees, supposed to be about 200 years old; and another avenue of 120 trees, averaging about 28 feet high, and about 160 years old. The Tisbury yew, 37 feet in circumference, and entered by a rustic gate; the interior of this tree once accommodated seventeen persons, who breakfasted there. The Ifley yew supposed to have been planted before the Norman conquest, with a girth of 20 feet at two feet from the ground. The Ankerwyke yew, near Staines, supposed to be up-

wards of 1,000 years old, underneath whose boughs Henry VIII. and Anne Boleyn used to meet. Girth three feet from the ground 27 feet 8 inches, and at eight feet 32 feet 5 inches. Besides the following other remarkable yews, a detailed description of each not being necessary:—the Arlington, Darley, Llanthewy, Gresford, London, Cruxton, &c.

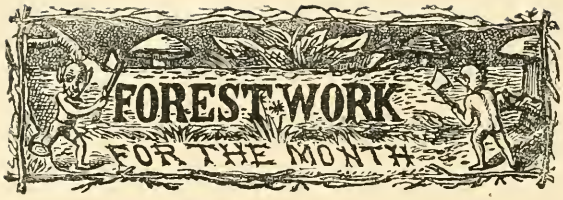
Such is a brief account of the traditions surrounding this tree, which Blair apostrophises as—

> "Trusty yew,—
> Cheerless, unsocial plant, that loves to dwell
> 'Midst skulls and coffins, epitaphs and worms."

Schools of Forestry.

At one of the meetings of the Social Congress at Aberdeen, the Rev. John C. Brown, LL.D., read a paper on Schools of Forestry, viewed in relation to the importance of organizing such an institution in Britain. Dr. Brown at the outset referred to the fact that there were schools of forestry founded in every other country of Europe, with the exception of Holland, Belgium, and Denmark. He pointed out the great pecuniary advantage that had been derived in India from administering the management of forests in accordance with the advanced forest science of the day. He also described what was being done at present in New Zealand and in several of the United States of America to introduce an improved system of forest economy. He showed that in some countries the schools of forestry were independent institutions, while in others they were connected with universities, Agricultural Colleges, and Polytechnic Schools. He advocated strongly the importance of providing such education in this country, maintaining that, at an expense of between £300 and £1,000 a year, the Polytechnic School now being founded by the companies of London, or any one of the Scottish universities, might be made to provide facilities for the study of forest science equivalent to those of the most thoroughly equipped schools of forestry on the Continent; and stated that, while candidates for employment in the forest service in India—with salaries ranging from £300 to £1,900 a year and corresponding advantages—were at present required to study forestry on the Continent, such studies might then be brought within the reach of young foresters and young gardeners, and others practically acquainted with arboriculture from childhood.

The chairman, in proposing a vote of thanks to Dr. Brown for his paper, said that the subject was one well worthy of consideration. They had been warned of the diminution of the supply of coal, and as wood was the only equivalent they had for coal, the study of the management of timber came to be of great importance.



ENGLAND.

Fetch up arrears of trenching, ditching, pruning, trimming hedges and woodrides, cartage of materials, holing, tree-washing, &c., and pay particular attention to the fences around woods and plantations. As the pastures become shorter, cattle are the more likely to wander into the woods in search of food.

Where it is intended to have an early sale of coppicing the allotment, or "canting out," as it is called in some parts of Kent, should be proceeded with; always bearing in mind that small lots, by inviting more competition, command relatively higher prices than larger ones. The divisions here are called "sesses," and the subdivisions "cants." The process of marking out the cants by cutting off straight lines of stub throughout the sesses is called "washing out the rides," and is paid for by the purchaser at the time of sale, at the rate of two shillings per acre. The form of contract in use is as follows:—

1. The highest bidder to be the purchaser, &c., &c.

2. No person to advance less than five shillings at each bidding.

3. The lots to be taken at the measurement in this particular, except where otherwise stated.

4. Thirty tillers per acre to be left, twenty of which shall be oak, if as many can be found. All tillers marked to be left unhurt, or the purchaser to pay two shillings and sixpence for each one broken and all oak, &c., left before to remain. No cattle to enter the woods after the 5th of May, 187-, without nets or muzzles.

5. The purchaser to pay half the amount of purchase-money at the time of sale, and the remainder on or before the 14th November, 187-, and give security if required.

6. The wood to be off the stub by the 1st of April, 187–, and off the premises by the 1st of June following (except plantations, which are to be cleared by the 20th April), or forfeited to the vendor. The wood to be carried by the usual roads, and the purchaser to make good all damage done to gates, fences, &c.

7. The purchaser to pay two shillings per acre, in addition to the purchase-money, at the time of sale, for laying out and measuring.

8. The vendor reserves to himself or his agent the right of one bidding.

Then follows the usual memorandum of agreement to be signed by the purchaser.

The forester's principal operation during October should be planting, and the collection of such seeds as ripen during the month. I would repeat here a maxim which I have elsewhere quoted—"Plant before Martinmas (Nov. 11th), and *command* growth; plant after Candlemas, and *entreat*." The advantages of early planting (except in very wet soils, which should speedily be drained) are numerous, and need not be repeated here.

Among the seeds which ripen during October may be mentioned the Norway maple and walnut, in the early part,—the sycamore, horse-chestnut, and birch, about the middle,—and the alder, ash, beech, and generally the oak, towards the end. Though the collection and care of these seeds come more immediately under the department of the nurseryman than that of the forester, yet, as a good home nursery, proportioned to the breadth of woodland and the probable demands of future plantations, should be found on every large estate, some remarks upon the subject may not be out of place here. As the seeds of the oak, walnut, sycamore, horse-chestnut, and Norway maple should be sown as soon as collected, it will be necessary to have land in readiness for their reception. Where it is difficult to keep these seeds from the attacks of rooks and other predaceous birds and the small rodents during the winter, spring sowing must be resorted to. But autumn sowing will often give a whole season's start to the seedlings, and is consequently likely to repay a little extra trouble and outlay. Plant in drills sufficiently wide to admit of hand-hoeing and weeding. Proportion the quantities of seed and breadths of ground to future requirements. One bushel of seed of average quality and with proper care will produce about the following numbers of plants:—oak, 6,000 to 8,000,—Norway maple, 12,000; sycamore, 12,000 to 13,000; walnut, 4,000 to 5,000; horse-chestnut, 2,000; ash 12,000 to 15,000; beech, 10,000 to 12,000. The lighter the smaller seeds are covered the better. If placed beyond the reach of heat they will not germinate.

It is always better to secure seed from trees of medium age: the produce of very young trees generally proves barren, and that of aged trees furnishes plants of a weakly growth. Bear in mind that the seeds of hornbeam and ash do not germinate till the second spring.

October is a good time to cut back two years' transplanted oak,

chestnut, and ash, where necessary. Remove ash of this age that do not require cutting over, and put them in lines 3 feet distant, and about 18 inches apart, after pruning them carefully. Take up layers of lime tree and place them in rows, at intervals proportioned to their sizes, bearing in mind that they should not again be removed for three years. Plant cuttings of poplar about 18 inches in length, taken from the last year's shoots, and leave them about 6 inches out of the ground. The abele, which flourishes in swamps and on the margins of streams, may be propagated from layers, cuttings, or suckers.

Cut off the tap-roots of the small oaks standing in lines, with a very sharp and oblique-pointed spade, which should be gradually worked along the whole length of the rows, and a few inches beneath the surface of the ground. By such means the production of fibrous roots will be promoted, and the chances of successful transplanting increased.

Transplant from the seed-bed larch which have stood one winter. Where the object is to bring them forward very rapidly, they may be removed to the lines the autumn after sowing. Scotch and spruce will in all cases require one year more than the larch before they are ready for their permanent positions. To prevent exposure of the roots of seedlings and all very young plants during the operations of sorting and carrying, immerse the roots and a few inches of the stem in a puddle of clay and water. In throwing out the trenches, allow the soil on the one side to remain unmoved, that it may form a firm support to the transplants. All plants intended for removal should be raised immediately the leaves fall off. This is also a good time to cut off, at a distance of five or six inches from the ground, all young elms which are intended to grow shoots for layering at the end of two years.

Pluckley, Kent. ALFRED J. BURROWS.

SCOTLAND.

OWING to the harvesting operations not being completed, hedge trimming will have to be continued this month until all those around arable fields are finished off.

The farmer should be consulted in regard to those fields that are to be laid down in pasture, and the hedges enclosing such fields must be very sparingly dealt with; indeed, if they are thinly made up they should be passed over altogether. Cattle and sheep seem to delight in browsing on hedgerows, and as a rule keep them well enough under without much aid from the knife.

All the gaps in those hedges will have to be fenced up likewise, as

sheep are frequently turned out to eat down the young grass before winter, and the destruction wrought in a single night by a score or two of hungry sheep, amongst young plantations in particular, is too well known to need any comment by way of urging every forester to make sure that it will not happen.

This is the proper month to inspect and repair all game-proof fences, for when hares and rabbits once find their way into forbidden ground it is an almost hopeless task to try to keep them out. Just to show how careful we ought to be in this respect, I may mention that last winter my garden gate was left open one night by mistake, and three hares found their way in, and very considerately eat over a bed of fine carnations. On turning in some men the following morning to drive them out, we saw the whole three with a very slight effort skip over the upright paling nearly four feet high; some of them were frequently seen in the garden after that, and the only means of getting out and in was over the top of the said fence. Perhaps this was an exception, but there is no doubt that it is a good thing to keep such fences in thorough repair, and thereby lessen the risk of an invasion from what are acknowledged to be on all hands our deadliest foes.

A notice appeared in the newspapers some time ago of an effectual method of preventing rabbits scraping under wire netting. The plan recommended was to dig a trench sloping outwards from the fence, in which to bury the edge of the netting.

The gentleman who tried the experiment said that it completely baffled the vermin in their attempts to scrape through, their instinct not leading them to begin far enough back so as to get under the wire.

A sharp look-out must be kept also on those trees that are not fenced in, and which are liable to be attacked by rabbits.

It frequently happens that a most unsightly gash is made in the bark, and then the tar mixture is applied after the mischief is done. It is much the best and safest plan to go beforehand and apply some of the mixture in a well-diluted state, and thereby save the trees from being attacked at all by the nefarious vermin.

Owing to the backwardness of the season, the felling of heavy timber should be delayed until next month, by that time the leaves of the trees will be shed, and the wood properly matured.

Meanwhile, the brushwood surrounding those trees can be cut and cleared from the ground, which will very much facilitate the subsequent operations of felling and snedding the trees.

It is to be hoped that advantage has been taken of the long spell of wet weather experienced lately to get all the workmens' tools ground up and put into the best order, ready for action; also that every man has a double set of both axes and knives at his disposal, so as not to

necessitate a run home to the grinding stone if anything should happen to one or other of his tools.

Look over nursery stock, and select the plants required for planting operations during the incoming winter. See that such stock is kept clear of weeds so as to give it every chance to fully mature its growth.

Dalkeith Park. ROBERT BAXTER.

IRELAND.

GENERAL forest work should now be carried on with vigour. Thin all sorts of plantations where required. In conducting this work no forester should allow himself to be persuaded that unless he follow certain prescribed rules he will invariably go astray. Never cut a sound healthy tree as long as a tainted, diseased one remains in the forest, is the best axiom to be guided by. When thinning, draw a proper supply of fencing material to the wood yard, and during wet days have it manufactured into posts, rails, gates, &c. By this plan workmen will on wet days be kept profitably employed.

The past extraordinarily wet season has rendered the saving of turf, our staple fuel, impossible. Foresters should therefore embrace the opportunity, and dispose of all brush strewn on the ground without delay. On estates carrying out a regular system, the annual expenses of ten or twelve men are more than paid by the proceeds of auctions of fuel. Old hedges should now be renewed by "cutting over" and plashing.

Springs being now opened, ground recently drained should be looked over to see if any extra drains are required. Plantation roads also require to be examined, and any water flowing over them turned off. This is particularly so with new-made roads, as the side drains may not be quite effective.

A good deal may now be done in the nursery. As plants are removed to permanent situations, empty spaces should be top-dressed with a rich compost previously prepared, and replanted with seedlings from the seed-beds. Seeds should be gathered as they ripen, and put in the rot heap or stove for spring sowing.

It is important that every gentleman's nursery be well stocked with thorns. Growing thorns from cuttings is very simple. When stubbing out old hedges, take cuttings off the roots and plant in the nursery: they will the next season throw up a luxuriant growth.

On the farm, open watercourses ought to be inspected, and obstructions removed. Commence deep tile draining, make new and alter and repair old roads, gravel carriage drives, and make new ones where

required. Excavating, levelling, and filling up of ground should now be proceeded with.

There is a great abundance of seed this year on beech, sycamore, ash, spruce, silver fir, holly, haw, and mountain ash, but a total absence of acorns.

D. Sym Scott,
Forester.

Ballinacourte, Tipperary.

WALES.

The preparing and enclosing of ground for planting should be continued, as last month. Where the ground is naturally dry and the soil congenial, or where it has been rendered thoroughly dry by being previously drained, it may be planted towards the end of the month, and the work should be pushed forward during favourable weather, before the winter sets in, and the weather becomes less suitable for planting operations; and where the ground is of a damp or stiff tenacious nature, or only recently drained, planting may be advantageously deferred till spring, by which time the drains will have had their effect upon the soil, and the ground in other respects made more suitable for the reception of the plants.

The thinning of young plantations of the fir tribe may be proceeded with, but hardwood plantations, comprising ash, elm, sycamore, and other broad-leaved, deciduous trees, may be left untouched till the end of the month, or until the leaves have fallen. The year's growth of new wood will then have ripened, and the timber more saleable, as being in a better state for after use and preservation than when cut full of sap, and less liable to injury in felling and removing. Continue cutting hedges and pruning forest trees where not already done. Have all open drains and outlets in existing plantations cleared out and put in proper working order.

Keep all wire and wooden fences in good repair. Transplant evergreen trees and shrubs as last month, and roll walks and grass in pleasure-grounds; and where alterations and turfing are being done, push it forward with all speed during the present month.

Lewis Bayne.
Kinmel Park.

[*Correspondents sending letters signed with initials or fictitious names are requested to enclose their name and address, as otherwise their communications cannot be inserted. Two or three interesting letters are held over this month through want of space.*]

PRESERVING OF WOOD POSTS.

SIR,—I am much obliged to the two gentlemen for the healthy criticism they have bestowed in your last number upon my iron prongs. It is evident they want more information on the subject before they can be satisfied about the advantages claimed for them. I now take the opportunity of conveying that information.

I hope "M. R." will give me credit for having entertained a scepticism analogous to his own about departing from the old orthodox method of fencing. I can assure him that the step was not taken until I had made it quite certain to all concerned that the adoption of these prongs would result in a saving of labour and material.

I was also aware that iron had a deteriorating effect upon wood when brought into contact with it, but the point to be decided was this: Whether a stob driven into the ground in the usual way, or one nailed to an iron support, would last the longest? Now I think all experience goes to show that you may drive "nails, staples, &c.," into a stob, and after the lapse of fifteen years or so find that they have made but a very slight impression upon it, while that part of it which has come in contact with the soil will be found to be quite rotten. So that as far as this comparison goes the advantage lies with the iron and wood, as against soil and wood. Observe also that the stobs which I operated upon had stood their allotted time, and in the usual course of events would have been knocked off as firewood, whereas they are by this additional support made to do duty for other ten years at least. Then as regards their power of resisting pressure from wind or stock, I can only say that for several months in the year there is a herd of West Highland cattle kept in the field, and the fence is standing as erect to-day as it was when repaired nearly three years ago. Our fields here have certainly one great advantage, namely, good solid turf on both sides of the fence, which gives to the prongs great staying power.

I will be candid enough to state, also, that for many years hundreds of beech stobs were used here for fencing purposes, entailing an almost endless round of repairs; that, however, has now happily come to an end, and the proposal that I made was to take this very inferior beech stob, and make it last as long as an oak one (we can't afford larch here),—in other words, virtually to give to "M.R.'s" figurative Scots fir axe handle the quality of an ash one. We must bear in mind also that the iron supports by being occasionally taken up and tarred would last for a hundred years.

Let us look now at the question of expense. Our stobs are all squared at the saw-mill, and have to be carted a long distance to and from that place, so they cannot be laid down for less than sevenpence apiece. Two men engaged repairing fences in the old style on an average go over fifty yards a day; the stobs are three feet apart, and the old holes are firmly beat in, the rails also are joined at the ends by splicing done with the adze. So that for every hundred yards we have an expenditure of £2 18s. 4d. for material, and for men's wages at 3s. a day 12s. in all £3 10s. 4d.; for the new method, 100 prongs at 6¾d., cost £2 16s. 3d.; men's wages for half a day 3s., in all £2 19s. 3d., nails used for both purposes being about equal, thus leaving eleven shillings and a penny for every hundred yards in favour of the new style, with this other great advantage, that there are no rails broken in the latter process, which cannot be said of the former. I can only say in closing, that the experiment, after a three years' trial, has given myself and those whom I serve complete satisfaction.

I hope Mr. Slater will let us know the result of his experience with the zinc and white-lead, as it gives people additional confidence to know that the plan has been well tested and found successful.

I would be very willing to send you a sketch of these iron prongs, but feel it would be advertising other people's goods in our Journal for nothing; but I trust the firm that supplies them will see it to be advantageous to their own interests to advertise them fully in your columns.

Dalkeith Park. R. Baxter.

Sir,—In your last issue of the Journal, page 355, I notice two articles commenting on Mr. Baxter's system of supporting, by iron prongs, stobs of posts which have rotted over at the surface of the ground.

Although not at all in favour of his plan, still I am of opinion that he and others deserve the thanks of all foresters, &c, for noticing and discussing a question of so much importance. It seems to me that your correspondent "M. R.," while exposing in his own way the fallacy of a plan which doubtless was apparent to the host of your readers (looking at it from an economic point of view), might at the same time have suggested or submitted a better. His remark about the beech stob does not amount to much. It is a well-known fact that beech posts soon rot over at the surface of the

ground, while the upper part will last many years, and might thus be utilized in the manner alluded to. Mr. Slater's system deserves some consideration, but to my mind it is too laboured and elaborate. I would be glad to know if he has had any considerable experience as to its efficacy. I cannot help thinking that in a few years these half-inch tacks with which he secures the zinc (lead is too dear) would give way, and I am dubious as to the durability of white-lead under ground. The post or stob first gives way just at the surface of the ground where the wet and dry meet, and of course this is attributable to its being alternately wet and dry according to the weather, but generally in a sort of half-dry state. Now, in any case the wood draws moisture from the ground, encase it as you may, and the less moisture it draws to the part at the surface of the ground the sooner it decays. Those who have had experience in fencing know that a post or stob gives way sconest in a dry bank. My experience in fencing has taught me that for a permanent wooden fence the most economic and satisfactory post is larch, cut in the proper season of the year ; the bark will then adhere closely, and is the best preservative. Saw and case up the posts in a dry place, and there leave them six months or longer to season; give two coats of hot gas tar, or char that part of the stob which will be a little above and under the ground. If the fence is a wire one, keep the wires tight, and your stobs will last longer. I will be very glad to hear of any practicable plan to preserve posts in a more satisfactory manner. On some large estates in Scotland all heavy posts for wire and other fences are placed in a long tank made for the purpose, and steeped in a solution of corrosive sublimate for several weeks till thoroughly saturated; they are then taken out and cased up to dry before being put in the ground. That this is intended as a preservative against rot many strongly doubt, but being a most virulent poison, it is no doubt an excellent protective against the attacks of all sorts of worms, insects, or fungi.

A. B.

Sir,—I think your correspondents who write about the preservation of posts and fencing, and advocate old remedies as if new, and having some merit, should at least be logical in their statements. Mr. Baxter writes about the decay of posts, and proposes, by way of helping to solve the problem, to drive iron prongs alongside decayed "stobs" and nail them there. Will he favour us by saying what shape are the prongs that are driven into the ground? What sort of soil the ground was? Whether more than one prong was used for each stob, and whether nailed to the stob below the line of decay as well as above ?

The concluding proposition of "substantial cast-iron sockets sunk in the ground with suitable bolt holes at top to which the posts could be firmly screwed," &c., looks like slender experience of the properties of either wood or iron. In common fairness I give him the chance of criticising my remedy for decay of posts and spurs. Whatever wood you may use—o

which oak and acacia are the best, and birch and beech the worst—be sure the wood is sound and seasoned, without sap in it; when ready to fix up, burn so as to char the surface of the post for about eighteen inches, nine inches above the ground line and as much below; while the post is still hot well saturate the burnt part with warm coal tar, and let it stand a few days to harden. The post hole should be large enough to ram the earth well all round it, especially at the part resting on the ground, using clay if possible. When fixed to within nine inches of the ground, level, and, to the width of the rammer all round the post, shovel in a mixture of mortar or any cement more tenacious than the soil itself. Spurs are only requisite here and there to help where there is extra strain on the fence. They must be served the same as the posts. Tar afresh every four or five years. One way of patching fencing where the posts have broken off, but are sound above and below the ground, is to saw out the decayed parts, say four inches, and lower the fence that much, driving down and nailing by the side of it a good oak or acacia slab, and on the other side nail a straightened out tyre "strake" on to the broken post, ramming clay or mortar well round it.

AN OLD FORESTER.

THE CULLEN PRICES.

SIR,—I am glad to see that my friend and neighbour Mr. Smyth is again well, and able to enliven your pages. As an intelligent practical man, and not far distant, he should know not only the fact itself, but the reasons why certain kinds and classes of timber, and other descriptions of wood produce, are higher at Cullen than any other part of Scotland, probably of Britain. This is neither a new nor a strange thing, for in 1866, the year I came to Cullen, a transaction had just taken place before I came by which higher prices (considerably) were effected than those I quoted. If Mr. Smyth would turn up some of the back numbers of the *Banffshire Journal*, where our auction sale prices are quoted (not by me), he will then find corroborative proof of my statement in regard to prices.

Mr. Hendry, auctioneer, Keith, has been salesman since the decease of Mr. Raeburn, and he will, I doubt not, confirm what I have said as to prices. Mr. William Smith, Mr. W. McIntosh, Mr. George Slater, Mr. George Smith, boatbuilders, Portessie by Buckie, and a score of others I could name, can all testify to having bought and paid for timber here at the prices quoted, not once or twice, but regularly as the sales occurred. I need not, however, prolong the discussion on its present basis, since what I have quoted as correct and true prices realized here have not been denied by Mr. Smyth, but only carped and cavilled at in a rather undignified manner. If Mr. Smyth has proved that no such prices are obtained at Cullen because they are not obtained at Banff or Macduff, by the same parity of reasoning I might prove that no Colorado beetle ever

came to the post office of Macduff because none ever came to Cullen; or because Cullen cannot boast of a celebrated naturalist, therefore Banff cannot and never could boast of such a hero as Mr. Edwards.

"He that questioneth much learneth much," says Lord Bacon, therefore Mr. Smyth must, at his present rate, soon be quite an embodiment of learning. I have neither time nor will to say more upon this subject, and if Mr. Smyth is disposed to prolong or enlarge upon it, I shall not likely further interfere with his performances.

C. Y. MICHIE,

Cullen House, Cullen, N.B. *Forester.*

SIR,—As "Ancora Imparo" has now given his name, &c., in full (page 356), you will perhaps allow me to say a few words about "the *Cullen House* prices," and Mr. Smyth's statements thereanent. As I have not all the numbers of the Journal beside me, I cannot go into the matter fully, but I have no hesitation in saying that Mr. Smyth accuses Mr. Michie without sufficient proof. My reasons for believing Mr. M.'s prices to be reliable are, because I have obtained even higher prices than stated by him, and that for very inferior wood, and within fourteen miles; also timber sold here during the last four years realized fully the prices quoted, taking the whole sales, private and public, together. Not later than Saturday last (8th), at a public sale held here of very inferior timber, the prices realized were very high: *small* spruce and Scots fir, 1s. to 1s. 9d. per cubic foot; *larch, inferior*, 2s. 2d.; beech and other hardwoods, 1s. 3d. to 2s. None of the timber was measurable; some spray or brushwood sold as high as 4s. per cart-load.

[This timber not being measurable is no evidence of the price per cubic foot.—*Ed. J. F.*]

Meldrum House. D. F. M'KENZIE.

SIR,—When your JOURNAL OF FORESTRY was started I became a subscriber, and have read the contents of the numbers already issued with much interest. Having been brought up from my youth in the wood trade I naturally take a great interest in forestry and all its belongings, and I therefore wish your journal, as it deserves, great success.

I have, however, been rather amused at seeing the discussion now appearing in your columns between Mr. Smyth, Forester, Duff House, and Mr. Michie, Forester, Cullen House, as to the current prices of home-grown timber in this district; and the great difference in their quotations must appear to those unacquainted with the locality the more surprising, when they hear that the two estates adjoin, and the quality of the timber grown on both is similar.

With regard to this matter I may just say that during my thirty years' experience in this business I have bought timber from most of the landed proprietors (including Lord Seafield, Cullen House) within a boundary of 20 to 30 miles, and I never heard of, nor paid, nor got anything like what the Cullen House Forester quotes in your first number, page 31, and I will now offer as good quality of wood as ever grew on the Cullen House estates at 30 to 50 per cent. less than the Forester's quotations, for the reason that I cannot get those prices anywhere. It happens sometimes that a farmer or a boat or ship builder may go to a forester or timber merchant in quest of a few pieces of wood which must be had of a certain description, and for which an extreme price may be paid, but this I maintain should not be quoted as being the current price of timber in a district.—I am, Sir, respectfully yours,

Macduff, Sept 19, 1877. ALEXANDER DALLAS,
Wood Merchant.

SIR,—I have watched with much interest the discussion upon these long prices at Cullen, and I have simply kept quiet till now to see what was to be the result between the two foresters. I am afraid, from my own experience in the trade, Mr. Michie will have some difficulty to prove to us wood merchants that he can get such large prices at Cullen. I have sold almost all sorts of home-grown timber in and around Cullen, and I find those in the trade there know the current market prices as well as I do myself, and can drive as hard a bargain. Mr. Michie's prices look somewhat preposterous on the very face of them, when he says he can get 1s. 6d. per foot for Scots fir, when I have to pay railway carriage to Aberdeen, and get only 1s. per foot: of course mine is correctly measured. Then as to his ash at 4s. 6d. Certainly he could not think we wood merchants would believe any such thing, whatever foresters might do. I have on hand at present from 1,000 to 1,400 ash trees of excellent quality, and should he be so kind as to send a substantial customer my way, I would only be too glad to treat with him for something less. Then as to his other prices, I consider they are simply not worth taking notice of. I was very glad to see that they were completely refuted by Mr. Smyth's remarks in the last number. I am anxiously looking for the next number to see what he has got to say in explanation; but possibly he will take no further notice, which will be much the better plan for himself, as the numerous readers of the JOURNAL OF FORESTRY will have their minds made up by this time as to the accuracy of his statement about such enormous prices being realized. Had I not been in hopes of getting a customer recommended prepared to give the Cullen prices, for which I would gladly sell out, I would hardly have cared to waste time and your space in noticing the matter.

AN ABERDEENSHIRE WOOD MERCHANT.

[The Correspondence on this subject must now cease.—*Ed. J. F.*]

PROTECTING RIVER SIDES.

SIR,—I have read with interest the paper of your able contributor in the last number of the JOURNAL OF FORESTRY on the subject of protecting river sides, and have derived valuable information therefrom. Your contributor, Mr. Scott, very truly remarks that proprietors look upon those they employ as able to direct on proper principles all the affairs of the landed estate ; and I think it will not be out of place, while the subject is before your readers, if I venture to ask for some extended information upon the means of protecting banks against large and rapidly flowing rivers, running through or alongside the grounds of mansions, &c.

I was called upon some few months ago to advise as to the best manner of resisting the incursions of the River Thames (in Berkshire), which was rapidly gaining way upon a large extent of lawn and grounds. I found that the usual method in the locality was by putting down what is called "camp-shedding," which, generally described, is the driving down strong piles, to the inside of which are fixed stout planks seen at intervals to the solid bank by iron "land ties," the empty places between the piles and worn bank being filled up with earth, stones, &c. The prices for this sort of work varied, according to quality, from 25s. to 40s. per lineal yard, which, where there is any extent of bank to be protected, involves a serious outlay. It seems to me that there must be some cheaper and effectual method which would answer the purpose, and still preserve the bank in its neat and ornamental character. On portions of the same property upon which the river was encroaching willows had been planted, apparently with great success, many years ago, but as the banks were steep and the current strong, these were mostly leaning almost horizontally over the water, and seemed as if before long they, along with the bank on which they were growing, must become the prey of the river. Young plants, I conclude, in such cases should be supplied from time to time.

I should be glad of any information on these matters which your useful Journal may be the means of supplying.

J. F. L. R.

September 5, 1877.

PRICES OF LARCH BARK.

SIR,—The prices obtained for various classes of timber and in some districts of the country have already been discussed at considerable length in the pages of the Journal ; and I have been wondering that this subject has never been touched upon, *viz.*, the high prices of larch bark at Rossdhu (p. 31.) I have had a most extensive experience in this department

and in one year I had among other duties the superintendence of stripping upwards of 30,000 larch trees, which yielded, if I recollect correctly, about 227 tons of bark. Having such a large quantity on hand caused some anxiety both to my employer and myself, and we took offers from all the tanners we knew or heard of between Arbroath and Edinburgh, as well as down the Clyde as far as Rothesay. Samples of from 2 cwt. to a ton were asked, and duly sent, for examination and testing. All parties acknowledged it to be good bark, and the highest sum we pocketed for the ton delivered was £4 5s. The trees from which it was stripped were about thirty-five years of age, and in a very healthy condition. I may also state that I offered to let by contract the felling, pruning, peeling, stacking, and thatching, and got an offer for the whole work, at 27s. per ton. I considered this rather too high, and let the felling and pruning only by contract for the sum of 6s. 3d. per 100 trees, which was very cheap indeed. I retained the peeling, &c., in my own hands, and employed a large number of women to perform the work, some from the neighbourhood and others from a distance. The highest wages I paid were 10s. per week, and though I cannot now give a definite account of the expense, I am quite sure that every ton of bark cost me for peeling, rancing, stacking, threshing, and bagging somewhere about £1 per ton. I had twelve miles of cartage exclusive of railway carriage, and I leave any one to judge for himself if the Rossdhu prices are likely to be realized. A few years ago I sold some excellent larch bark for the sum of £3s. 17s. 6d. delivered, this being the highest of several offers I got for it.

Those who are ignorant of current prices should be very careful when giving in such returns, so as not to mislead their brethren, and also injure the trade generally.

THOMAS WILKIE,
Forester.

Ardkinglass.

A SPANISH CRITIC.

SIR,—You did me the honour to speak in commendation in the number of the *Journal* for May of a pamphlet I had issued under the title of "The Schools of Forestry in Europe, a Plea for the Creation of a School of Forestry in connection with the Arboretum in Edinburgh." I find it and your review thus noticed in the *Revista de Montes*, published at the Escurial in Spain:—

"'The Schools of Forestry in Europe' is the title of an interesting pamphlet of seventy-two pages published by Dr. Brown, formerly Professor of Botany in the University of Aberdeen, and latterly in the College of Cape Town at the Cape of Good Hope. This work is interesting not only for the information which it contains in reference to a great number of schools of forestry in Europe, but also principally because it reveals the spirit which is beginning to be awakened and manifested amongst the men of science in England against the indolence which till lately had existed in that country in regard to forests. Brown, after having travelled through a large part of Europe, visited its forests, and studied almost all the schools of this department, augmented

his knowledge and experience in matters of forestry by his journeys in America and Africa, endeavouring constantly whilst travelling to give particular attention to the forests, and to everything connected with them. His voice is, therefore, of sufficient weight in this matter; and he himself seeks to enforce it by the opinions of other men of recognised authority, amongst others that of the eminent and learned Hooker, who, as all know who give themselves to the study of the natural sciences, is one of the principal leaders in the study of these.

There is to be found in this pamphlet information more or less detailed in reference to almost all the European schools of forestry—from those of Stockholm and Moscow to those of the Escurial and Vallambrosa; the conditions necessary in order to enter the forest service of British India, and the course of study which Dr. Brown believes most essential for an English school of forestry, which he believes might be established in Edinburgh, avoiding the necessity which at present exists for young men going to the French and German schools. Different countries in Europe have been and are threatened with the want of wood and of firing, by ruinous droughts and by devastating torrents; all are consequences more or less direct of the improvident destruction of the forests. England has abundant firing in her coal mines, and from her extensive colonies in North America she easily imports the wood she requires. From her topographical and climatal situation she is seldom exposed to long-continued droughts; neither has she the wide barren sands nor the extended downs which in different regions of the Continent it is necessary to arrest and utilize by means of plantations. She is now, however, beginning to experience in her colonies evils similar to those we have mentioned; public opinion is taking the alarm and demanding a remedy; and England is sure to make an effort and follow it out, taking from other countries all that appears worthy of imitation.

"In the same spirit, and with the same tendencies as the above-named pamphlet by Dr. Brown, the first number of *Journal of Forestry* published by Messrs. Rider in London, is edited. They intend to continue publishing it monthly. In the introductory number the editors express surprise that till now there has been in England no organ to centralize and give information in reference to its different forest interests, towering above all of which are those of India and the colonies. Desiring to supply this want, they have begun to publish the above-named *Journal*, which will in different sections discuss questions relating to forestry under the heads descriptive, historic, scientific, legal, economic, practical, and æsthetic.

"The index of the first number is indeed sufficiently varied, containing articles and notices on different sylvan operations; on the beneficial influences of trees, on ornamental woods, on the ancient forest laws of England, &c., besides which it contains a literary review, a section for correspondence, and another for varieties. The form is excellent, 72 pages octavo, large size, on good paper; the price of subscription in London 12s. yearly."

It is gratifying to have our feeble efforts thus recognised and acknowledged by collaborators who have been longer in the field.

I send with this a detailed account of the School of Forestry at the Escurial, which will show the amount of attention given to that science in Spain.—I am, Sir, respectfully yours,

JOHN C. BROWN.

Haddington, Sept. 20th, 1877.

PLANTING TREES AND SHRUBS.

SIR,—The planting of young trees and shrubs forms a very important part of the autumn and early winter work on every properly managed estate, therefore, with your kind permission, I should like to say a few words on the importance of thoroughly preparing the soil in which

planting is to be done. It is too often the case that all that is considered necessary is to dig a rough hole about a foot square, put in the young plant or tree, tread the earth in around it, and consider the work done, and as year after year passes by to wonder why the trees make little or no growth!

About twelve years ago I entered the service of a gentleman in the south of England, and he having determined to make a considerable number of clumps or plantations on various parts of the estate, especially on those parts near to and surrounding the mansion, it fell to my lot to see to the work being done in a proper manner. I advised my employer to have the whole of the ground trenched two feet deep, which he at once agreed to have done. The soil varied from good loam to stiff clay, and in some parts a shallow sandy soil resting on rock, the stone cropping up in places at less than a foot deep. Before the work of trenching was completed my employer was advised by a person in whom he had great confidence, that I was putting him to a great deal of unnecessary expense, and that if holes were dug two feet wide and one foot deep it would answer the purpose, and act as well as the trenching I was giving it. I protested against this, but without avail, and so the trenching was stopped, and holes were dug in the remainder of the ground, and the young trees were planted. They consisted of spruce and Scotch fir, birch, elm, and poplar, as well as various kinds of dwarf shrubs, all being alike strong and healthy plants. The planting was done in November, and every tree lived for the first two years, all appearing to flourish alike; but then we had a very dry, hot summer, when a change came quickly over the scene. Where the soil was trenched the trees seemed to revel in the heat, and sent their roots deep down into the good soil prepared for them, while the plantations not trenched appeared scorched and stunted and all growth stopped, many of the trees dying right out, and those that remained alive never recovered their former vigour.

On my present employer purchasing the estate we had the whole of the ground trenched between the trees still alive, but while this improved them very much none of them have reached half the girth of those originally planted on the trenched ground, many of which, on my leaving two years ago, were a foot through the stem, and pictures of health and beauty.

My object in this letter has been to show that, in order to obtain the greatest success in tree or shrub planting, the soil must be well prepared before hand, and if this is not attended to but very little satisfaction will be obtained from the result; at least, such is the experience of

THE SQUIRE'S OLD GARDENER.

CLEARING PLANTATION GROUND.

SIR,—Your correspondent M.R. asks the price per root it would cost by using one or other of the following explosives, dynamite, tonite, or gunpowder, in clearing land of tree stumps:—

Much, of course, would depend upon the size of the stump, and the number of large roots by which it is held in the ground. I have had a

good deal of experience in the use of dynamite and tonite; they are both about the same strength, but tonite is safer to handle from the fact that it contains no nitrogly-cerine, is always ready for use, and leaves no poisonous fumes.

Dynamite, on the other hand, is made up of 75 per cent. of nitroglycerine and 25 per cent. of pulverised clay.

The uncertainty of dynamite is such that you may use it for years without an accident, or one may happen at any moment. The use of gunpowder is an expensive process in clearing land, not being well adapted for the purpose.

I would recommend any person clearing land, either by dynamite or tonite, to use electricity, and where practicable put two small cartridges in the stump instead of one large one; you will do better work, as both explodes at the same time and one helps the other. There is another great advantage in favour of tonite, that the railways carry it, being safe in transit, storage and use. It does not require softening like dynamite, nor is there any unpleasant smell after it explodes. The railways will not carry dynamite.

I would recommend in all cases the use of a sufficient charge of the powder, to be certain that it is master of its work, because if you undercharge you will then have to charge again, and probably the first charge is entirely lost, and time wasted.

A few experimental shots will very soon tell you the strength requied to do the work.

When the trees have begun to decay in the centre it is useless boring them as there is not sufficient solidity for resistance. In this case it is better to bore from the side, and if a large root put in two or three shots, and fire by electricity.

I have often been solicited to introduce a cheap exploder for this purpose. I hope in the course of a few days to be able to introduce a magnetic exploder to fire at least four shots in single circuit, which will be quite strong enough, and so simple that it cannot get out of order except when trifled with. When done with it will sell for about as much as it cost, if properly cared for. I am endeavouring to bring down the price so that it will induce those engaged in clearing land to use it, being so much superior to the common fuse, because however careful you are in cutting your fuse to the exact length, if there is a second between the charges going off, there might as well be an hour. By electricity the whole goes off at the same instant, and the machine is so simple that any common labourer can manage it. If a heavy stump is to be removed, I found it very useful to place the tonite under the centre by making a hole with a spade, and placing a stone under the powder so as to get as much resistance as possible, and placing the powder under and as near the wood as possible. As many of your readers are interested in the clearing of land, and as your Journal is a good medium through which information may be obtained, I shall be happy to give any information to those so engaged in clearing land.

I may here remark that a great deal of practical information can be had

from practical foresters, but not being able to write so fluently nor express their ideas as they could wish, they do not like to write at all; indeed many probably cannot express their ideas on paper; and so much valuable information is lost. To such I would say, give the information in as practical a manner as you possibly can, write on one side of the paper only, and I feel sure our editor would assist such, and thus young foresters would learn from those older in years and experience.

To conclude, I would suggest that the older foresters would set the example and encourage those under them to read the Journal; and I hesitate not to say your Journal will not only double its circulation, but much valuable information will be communicated that is now lost to those much in need in it.

I am sorry to have trespassed so much on your space, but my object is really to draw out those who are now in the background, and in possession of many excellent ideas on different subjects connected with forestry.

EXPERIENCE.

WHAT SHALL I PLANT?

SIR,—I should feel obliged if some of your readers would kindly advise me in the following matter. The ground slopes down from my house to a public road, beyond which are some very unsightly farm buildings. These I wish to plant out, as well as the highway, since persons passing along it can see directly into my garden. The road is carried partly on a cause way, the land on my side abutting it, being low and occasionally flooded. Looking from my garden over these farm buildings I have a very fine view of the surrounding country, which I naturally do not wish to hide. In planting, it would seem that the four following points ought to be borne in mind:—

1. The trees should be quick-growing.
2. They should be such as will flourish in a moist spot.
3. Of a sort that will not grow to much over 30 feet in height.
4. They should be (preferably) evergreen.

If the soil were only suitable, I should think *Quercus ilex* the very thing. If I am driven to the willow or poplar tribe, would some one kindly tell me the sort most adapted for my purpose, and to advise generally on the case.—Yours obediently,

PLANTATUNES.

SPRUCE TIMBER.

SIR,—Mr. Baxter comments in your last number upon my observations regarding spruce timber, &c., and does not merely express his own views, but also seems to know those of foresters in general. The reason why I discussed the subject as I did was simply this: I thought in my own mind, from observations I had seen in the Journal, that a one-sided view of the subject was being taken by some of the contributors, and that statements of like import could be advanced in regard to any other class of timber now in use. For instance, only a few days ago I had a letter from a friend, saying he entirely concurred with my views upon spruce timber, and stated as an

instance of the necessity of thorough seasoning and good ventilation, that he had used a piece of pitch pine in the construction of a house eight years ago, and found that it was now entirely eaten away by dry rot, consequently it had to be renewed. Here then I might take up an argument against the use of pitch pine, and say spruce timber would last as long as pitch pine, while another party who may have used pine for fifty years would say the opposite. Therefore a simple statement for or against the durability of spruce timber is not enough, and a simple statement from an individual like Mr. Baxter, interested, I fancy, in the disposal of that class of timber he is seeking to lower in estimation and consequently in value, is not what I would expect. I maintain that the Dalkeith spruce is really not such worthless stuff after all, if cut at a proper time and well seasoned, and gets sufficient ventilation after being used in the construction of buildings, fences, &c. I had the keeping in repair of the fence referred to for five years. When I got charge of it I was told it was erected twenty-four years previously, and it stood two years after I left the place before it was removed.

When I left there were nearly three-fourths of the rails left on the fence (but I may mention there was only one on the top, and five lines of wire underneath). When I went to the place the oldest wood on the property was sixty years of age, and the next oldest forty years. The rails were cut out of the thinnings of these, chiefly out of the younger, which proves the value of spruce timber to the proprietor on the west coast of Scotland.

The largest trees must have been selected, no doubt. In regard to the stobs in this same fence, the original ones would count more than one-half of the whole number when I left. They were purchased from a neighbouring proprietor, shipped home and stored in a dry and airy shed during the winter months. By the latter end of spring they were thoroughly seasoned, when they were charred for two feet up the pointed end, and as soon as taken out of the fire, dipped in boiling tar; as soon as dried they were carted off to line of fence, and immediately driven in the line.

Regarding the piece of hardwood used at junctions of the rails, &c., I would advise a large enough hole being bored in it to allow a suitable nail to pass through it into the stob, and by using two pieces at all junctions of the rails, the nails will not split the hard wood piece at all. For my own part, if the stob and rail are sufficiently seasoned, I cannot see how any defect would be made in the fence by simply resting upon a small surface. Neither the strength of the stob or rail is reduced, and if the nail is firmly driven, I fail to see any weakness, and the placing of the hardwood, as described, does not affect the strength at all.

If Mr. Baxter wishes the argument upon spruce timber continued he should gather up a regular authentic account or a variety of statements regarding its quality, &c., &c., and give us a general summary of all the particulars, such as age, classes of soil grown upon, exposures, what season of the year felled, how it was seasoned, and where or to what applied, and

also state whether good or bad ventilation was introduced, and I guess his conclusions will very much resemble mine.

THOMAS WILKIE,
Ardkinglass, 14th September, 1877. *Forester.*

SCOTCH FIR.

SIR,—In passing through a young plantation the other day, two-thirds Scotch fir and one-third larch, about nine or ten years old, I noticed several of the Scotch fir dead, and others dying. On examination I found that they had been apparently very healthy until within a few years of their death. Last year's shoots were of an average length, and some even had grown six inches the summer before they had died. I found in several of them some beetles, *Hylurgus piniperda*, but not in sufficient numbers, I thought, to cause death. The beetles were in the main stem. I could not discover any in the young shoots where they generally attack. On pulling up a tree, however, I found that there was a cankered resinous swelling round the tree, just about, or rather below the level of the soil. On those trees which were quite dead it extended completely round, whilst it only partially encircled those which were dying.

There was a heavy crop of Scotch fir and larch on the ground previous to the present one, but before being planted the second time it was allowed a few years' rest, and then pitted. After the first crop was cut off, heather, grass, and bracken sprang up in great abundance, and it is a singular thing that there are fewest dead trees where the heather is most plentiful.

Have any of your readers noticed a similar occurrence in young Scotch fir plantations ? and can any one tell me the cause of it ? W. B. H.

Notes and Queries

[*The Editor requests the assistance of Readers in answering Queries, so that the usefulness of this Department may be maintained.*]

H.M.S. "CALEDONIA," &c.—In answer to your correspondent "G. S. B., inquiring as to the success of carbonizing by M. de Lapparent's process, I may state that the *Druid*, which was substituted for the *Spartan*, and the *Tenedos*, referred to in Laslett's "Timber and Timber Trees," were opened for repairs at Sheerness and Devonport dockyards in the spring of the present year, the result being that after a most careful examination no difference could be detected in the condition of the parts charred in either ship from the others not so treated.—*Thos. Laslett.*

CLEARING PLANTATION GROUND.—The prices of clearing the land referred to by "M. R.," page 362, would greatly depend on the locality in which it is situated, if labour is cheap or not, and if the roots could be sold. In this part of Scotland the work could be performed for £12 per acre, and the roots would realize 1d. each. When the roots are not old the best and cheapest mode is trenching, but obstinate roots could be advantage-

ously blown out, with either *dynamite* or *tonite*, at a cost of 1¾d. each, if properly worked. I would suggest that "M. R." trench his land 12 inches deep, instead of 9, as he proposes, so as to get out all the small roots, as the cost of trenching would be much the same.—*D. F. M'Kenzie, Meldrum House, Aberdeenshire.*

Composition for protecting Young Trees from being destroyed by Hares and Rabbits.—Perhaps some of the readers of the *Journal* would kindly inform me what is the best preparation (and the exact proportion of the different ingredients in such preparation) for applying to young forest plants as a preventative against hares and rabbits, such composition having been proved by experience to be uninjurious to the growth of the plants, and best suited for the purpose in view. Also the best and most expeditious manner, and the best season of the year, for applying such composition?—*A. B.*

Planting Hollies.—Would some of your readers kindly inform me which is the best time of year for planting young and transplanting old hollies of different varieties? Also which is the quickest growing variety of silver holly best adapted for forming an ornamental hedge?—*A. B.*

Transplanting Purple Beech.—Would any of your readers recommend the transplanting of a purple beech tree?—size, 12 inches diameter at surface of the ground; height, 25 feet; age, about 45 years; distance to remove, about a mile. The tree is at present growing on a stiff clay soil. Would be planted again on a kind of clayey loam. Would autumn or spring be the best time for removal?—*G. K. D.*

How to climb Trees.—A friend of mine in Canada would like to collect the eggs of various hawks and owls, which, as he informs me, breed in the woods near him; but he is deterred from this by the great size of the trees in which these birds build. What would be the best and easiest method of climbing trees from 50 to 90 feet high, and from 4 to 8 feet in diameter? for in such trees, he says, the much-wished-for eggs are located.—*T. W. Dealy, Sheffield.*

Limewood.—I am told by a "knowledgable man" that the wood of the lime tree kills bees. Is this the case?—*D.*

Birch Felling.—Could any reader inform me which is the best month for felling birch poles, say from 14 to 20 years old, to be sure of a good growth from the stools left in the ground?—*J. Wilson, Forester, Ludbourne Hall, Wickham Market.*

Osiers.—Can any of the readers of the Journal of Forestry inform me the best sort of willow to plant for osiers? The soil is well adapted for growing them, and well sheltered. Also the proper distance to plant, and what will cuttings cost per 1,000?—*H. S.*

Luminous Wood.—Can no reader answer the enquiry on the subject which appeared in last month's journal?—[*Ed. J. F.*]

The Tree Lifter. By Col. George Greenwood.
London: Longmans, Green, & Co.

This is a third edition of a work originally published some thirty years ago by the late Colonel Greenwood, a country gentleman who possessed remarkable facilities for investigating plant life, and a rare amount of assurance for insisting upon his ideas of vegetable physiology, especially in regard to the circulation of the sap, being received by the scientific world as the correct and final solution of that still much involved but highly important physiological question. We do not intend to follow the colonel through what he terms his "facts" of plant growth, by which he attempts to demolish the reasoning of Liebig, Bonnet, Lindley, and other eminent physiologists, in language which at times is more forcible than polite, and which the editor of this edition might have eliminated from the text without detriment either to its clearness or force. The colonel was no believer in the opinion that trees can ever exhaust the soil in which they grow of the elements which they extract from it during their period of growth, and which he maintains they return to the earth with interest during the annual fall of the leaf, and the period of their natural decay; thereby increasing the richness of the soil with each succeeding crop, until "the formation of bogs by the *over luxuriance* of woods may be one of the causes why many countries have ceased to be covered with forests"!

We will pass on from the wild theories and dogmatic assertions of the first three parts into which the book is divided, and make an extract from the fourth part, in which are given some sensible instructions on the important operations of Pruning and Thinning, which will interest our practical readers. He says:—

"For pruning trees to grow to their greatest possible height, the rules are simple, and are applicable alike to the nursery plant and the largest timber tree: keep a clear leader; cut off all branches large enough to compete with the stem on which they grow parallel to it; shrive the stem up one-third of its height; and cut all close to the stem. With these exceptions a tree

cannot have too many branches, as the returning sap from each contributes to the growth of all that part of the stem below it; . . . . but pruning like thinning a plantation, should be annual, and cannot be too gradual.

"In timber woods and plantations the trees should stand close enough to discourage the growth of many side boughs, or of any large ones. As the side-boughs become gradually overgrown, and before they are actually killed, they should be removed with a common saw, set wide for the purpose, and the axe and cross-cut saw should gradually and annually thin the plants out to greater distances from each other. Timber may thus be reared *without a single disunited knot.* . . . If the plants are left too close, weak poles will be the result; if they are left too wide apart too many side-boughs will be developed. Plantations should be planted too thick to grow and then thinned, taking the worst plants worst placed, and leaving the best plants best placed; regard being had to what is likely to suit the soil best, and what is intended to be grown permanently.

"No saying is more true than that 'fools may *plant*, but it requires a wise man to *rear* timber.' More than this, it requires a succession of wise men. It is extraordinary that those who by practice are annually convinced of the importance, nay, necessity of thinning their turnips by hoeing, so often neglect this principle in their plantations. The principle should be practised from the beginning; but if it has been neglected ever so long, 'Sapere aude, incipe.' Nothing has done so much harm to plantations as that, 'Oh, it is too late now!' It is *never* too late. Can it ever be too late to begin cutting out dead rubbish? Can it do harm to take out what is doing harm? Can the wind be let into plantations by cutting out denuded poles without heads? Go into such neglected plantations and boldly cut out the dead and dying rubbish, and then gradually and annually thin out the worst plants worst placed, leaving and relieving the best plants best placed. He who perseveres on these principles will very soon in his annual thinnings be cutting boards instead of bavins. besides eventually creating fine permanent plantations. Do not think it a matter of no consequence whether the dead and dying are cut or left standing. The absence of the dead and dying is of the greatest importance to the living. The space occupied by dead heads should be occupied by the living limbs of thrifty stems; and dying, attenuated, waving plants, under the influence and force of the wind, *whip* and denude their neighbours much more than stouter plants can.

"Thinning and pruning should work together, and both should be performed gradually. By rearing timber moderately close from the beginning, and thus depriving the side boughs and lower parts of the stems of light, we not only encourage the heads to grow upwards more rapidly, but prevent the overgrowth of the side branches. All side boughs that are to be taken away, should be gradually sawn off before they die and while they are small, since the new annual growth over a wound is curved till it is wholly healed."

As an example of the merit which pruning lays claim to, the author's remarks.—

"Suppose a nursery plant with two equal eaders; both are weak in comparison with the stem below, because each has only one half the sap which ascends through the stem, and also each has only its own descending sap, while the descending sap of both deposits on the stem below. If one leader is taken off, new vigour is given to the other. The growth which was formerly divided is now united, and the increase in the bulk of the stem of the leader left is now doubled. But this twofold increase of the stem above the fork is no

greater then the increase of the stem below the fork, the increase of which is in no way altered by the pruning, as it only receives from one stem the same quantity of descending sap which it would have received from two. Nor is the whole quantity of the timber produced by the tree altered, though it is infinitely increased in value by uniting in one long clean stem what would have been divided into the branches. Throughout all forest pruning, the same principle reigns as is here exemplified. Any argument to prove that the double increase of the single remaining leader deteriorates the quality of the wood would also prove that the quality of the stem below the original fork is inferior to that of the two leaders, or that the stems in general, which are the receptacles of the aggregate descending sap of the branches, are inferior in quality to the branches."

In the frontispiece is given a representation of a barbarous and happily obsolete "Tree Lifter" with its appurtenances; five pages of the letterpress being devoted to a description of the implements, one-fourth of that space to the advantages of lifting and transplanting trees with good balls of earth, with which all good foresters will agree, and only three pages of instructions in the method of performing the important operations of tree-lifting and transplanting, upon which subjects every intelligent forester knows ten times as much as the whole book contains.

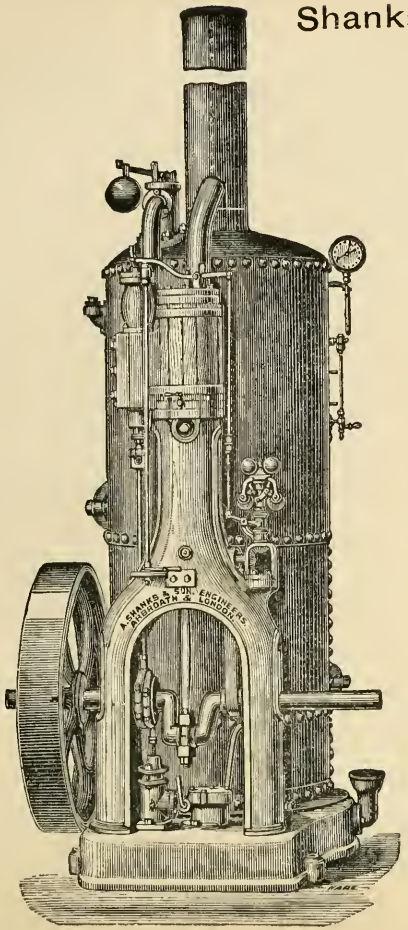
Notes on Forestry. By C. F. Amery, D.C., N.W. Provinces, India. Trübner and Co., London.

A small manual of 120 pages, with the rather pretentious object of laying down the principles of forestry, as applicable to the vast areas and widely separated localities of the forests in India, "in such clear language that one who had never before given the subject a thought might rise from its perusal with a good general idea of what to do and how to do it."

We can scarcely believe that Indian foresters are taught their profession in this easy, off-hand way. If such were the case, it would be an excellent speculation for the Indian Government to invest an odd half-crown in Mr. Amery's book, and "educate" its foresters at lightning speed for the merest nominal sum per head! The book really contains but a mere outline of forest science and foresters' duties, compiled chiefly from the French and German schools, and inculcating the ideas there prevalent, which in most points are about as applicable to the Indian forests as they are to those of England.

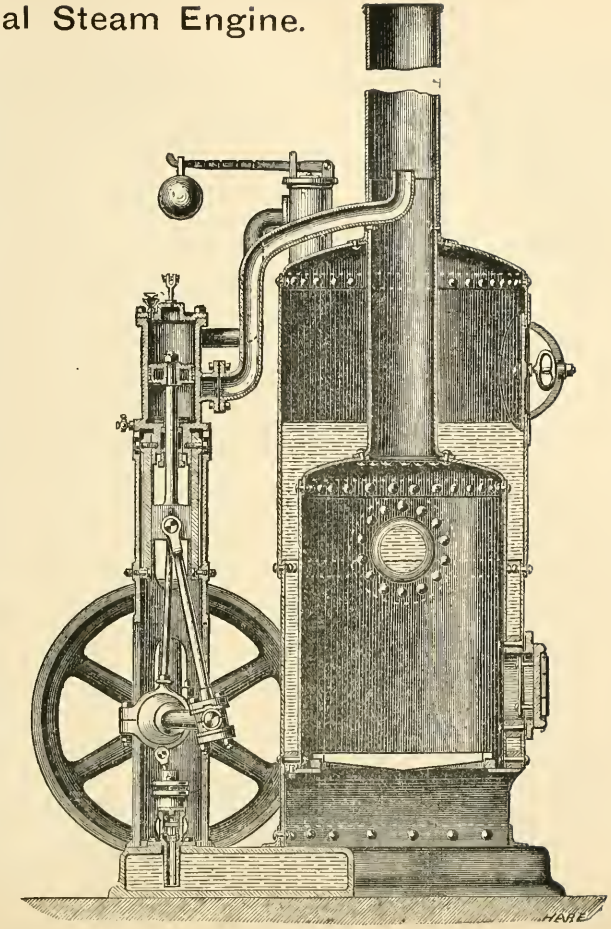
As matters are under the present system, it is possible that this elegantly got up little volume may contain all the knowledge that it is considered necessary an Indian forester should possess of the duties and practice of his useful and highly important profession; but when the system is established on a proper and satisfactory basis, a more extended knowledge will certainly be required of him.

Shanks's New Vertical Steam Engine.



When timber has been felled, the next operation it undergoes is its conversion into suitable forms for the market. To accomplish this several descriptions of saws driven by water, steam, or manual power are employed, but it is chiefly by the use of the *circular saw* that felled timber in its first stage is converted into the many varieties of forms and sizes in which we see it as an article of commerce.

It is manifest that these sawing operations could, in almost every case be more economi-



cally performed on the spot where the timber is cut down than they can be when it has to be removed from the forest in the state in which it is felled. The engines shown in the accompanying illustrations are particularly well adapted for the purpose of driving the various descriptions of saws here referred to; and since they are, we believe, amongst the cheapest in the market, economy and efficiency (the two main principles aimed at in commercial operations) are by means of them attained in a marked degree.

The working parts of the engines, which are few and simple, are, as will be seen from the illustrations, enclosed in a strong *cast-iron frame*, which not only affords them the necessary protection, but at the same time secures the most perfect rapidity in working. The boiler is of ample power and strength, and has a fire box sufficiently large for burning wood, thereby economizing the waste and useless timber, and converting it into fuel to keep the engine working at its full power. The engine is fitted with a very sensitive governor, and when required, the larger sizes are fitted with automatic expansion gear, by means of which considerable economy in the consumption of fuel is effected, and great steadiness is secured in working the engines, however much the variation of the "load" may be. Both engine and boiler rest upon a strong *iron base-plate*, which may be either of cast or wrought iron, and which at the same time is used as a tank for supplying the boiler with heated water.

A further proof of the adaptability of these engines for forest work is to be found in the facility with which they may be removed from place to place. The combined engine and boiler, in complete working order, consists of *four* separate and distinct parts, all of which can easily be removed. These are—

1st. The Boiler.

2nd. The Cast Iron Frames, containing the working parts of Engine.

3rd. The Base-plate.

4th. The Fly-wheel.

The base-plate has simply to rest on a level foundation, and the boiler and frame containing the engine lifted and secured to it by a few bolts. The steam-pipe connections are then made, and when the fly-wheel has been keyed on to the shaft, the engine is ready for work. A few hours are qnite sufficient to complete all these fittings, and no difficulty in adjusting the various parts can possibly be experienced by any one having even a superficial knowledge of mechanics.

These engines are made from 2 to 12 nominal horse-power. The working pressure in the boilers is 60 lbs. per square inch, and at this pressure the actual or indicated horse-power of the sizes manufactured varies from 4 to 28 horse-power.

Every engine is tested by hydraulic pressure to 200 lbs. per square inch before leaving the works. It will thus be seen that for safety, economy, and easy portability these boilers are not easily surpassed.

Mortality amongst Chestnut Trees.—The *Courrier de Bayonne* mentions that in the neighbourhood of Baigorry numbers of magnificent chestnut trees have been completely dried up this year, without any one being able to account for the singular occurrence. The sight which these trees present, wholly deprived of foliage, is most dismal; and what alarms the peasants more than anything else are the ravages caused by this new kind of plague, which has been also seen on a much larger scale in the district of Espelette. Even if the visitation should only continue for a short time, the fine clumps of chestnuts in the ravines of the Pyrenees will be entirely swept away, the produce of which is one of the principal means of existence and prosperity of the peasantry. Some attribute the cause to insect work underground.—M.

Sale of the Estate of Bordlands, Peeblesshire.—The Estate of Bordlands, belonging to the heirs of the late George Hope, Esq., extending to about 2,700 acres, was exposed for sale on the 19th ult., within Messrs. Lyon and Turnbull's rooms, 51, George Street, Edinburgh, and purchased at the upset price of £25,000 by Messrs. Mackenzie and Kermack, W.S., for Sir James R. Fergusson, of Spittalhaugh.

Planting of Trees in the Camberwell Thoroughfares.—The Camberwell Vestry seem at present inclined liberally to carry out the boulevard system within their district, which has already been adopted in Newington, the Borough Road, and other parts of South London. At a recent meeting of the Vestry, the General Purposes Committee recommended that 388 trees be planted in the public footpath on the west side of the Old Kent Road; 24 trees on the west side of Camberwell Road, extending from near Camberwell Green to Wyndham Road; 86 trees on both sides of Camberwell New Road, within the parish boundaries; and 60 trees on the south side of the Peckham High Road; the total number of trees proposed to be planted in the thoroughfares within the parish being about 560. Mr. Hunt, a member of the Vestry, objected to that part of the recommendation referring to the largest number of trees proposed to be planted, contending that the Old Kent Road was not a fit place in which to plant trees, but several other members considered that the work would be a great improvement, as well as healthy and ornamental, and the recommendation of the committee was unanimously adopted. The Vestry likewise approved a recommendation of the same committee to plant an alternate line of trees along a portion of the centre of Peckham Rye, together with the placing of seats, and that circular seats be also placed around certain trees named on the common.—*Builder.*

Sale of a Large Estate.—We understand that the extensive and beautiful estates at Pitfirrane and Keavil, in the west of Fife, have just been sold to Mr. Lawrence Dalgleish, of Dalbeath, at the price of £132,500.—*N. B. Agriculturist.*

What is Unmerchantable Timber?—A case of interest to the timber trade has recently been tried in the German courts. Messrs. Bryson, Jameson, and Co.,

of Hull, were the plaintiffs, and Messrs. Ludendorff and Co., of Stettin, the defendants. The plaintiffs claimed damages for defects in a cargo of oak timber, *ex* the *Thetis*, purchased from the defendants, it being alleged that many of the logs were not merchantable quality, owing to their being crooked, full of bad and rotten knots, &c. The case was originally tried in the Royal Maritime and Mercantile Court of Justice at Stettin, upon which a commission to take evidence before the town clerk of Hull was issued. The case was decided in favour of the plaintiffs, who were awarded the sum of £551 6s. damages, with interest and costs, upon which the defendants appealed. Upon the appeal the decision of the inferior court was affirmed, and the appeal dismissed with costs against the defendants.

Algerian Forests.—France has just sustained a rather serious pecuniary loss by the burning of three-fourths of the immense forests which she held in her Algerian colony. These forests occupied 200,000 acres in the province of Constantine, and 150,000 acres have been destroyed.

Laburnum trees are in full blossom at Bath.

Errata.—In Mr. Jandrell's interesting account of the coniferæ at Hawkstone there were one or two printer's errors. No. 2 was stated to have been planted fifteen years; this should have been twenty-five years. Also No. 2 Wellingtonia has been planted only twenty years instead of twenty-six.

India.—Mr. J. M'Kee, assistant conservator of forests of the first grade in the Central Provinces, has been appointed to officiate as assistant controller-general of forests during Mr. Home's absence on leave.

Obituary.—We regret to announce the death of Philippo Parlatore, the Director of the Royal Museum of Natural History and Physics at Florence and Professor of Botany. Professor Parlatore was born at Palermo in 1816, and died on the 9st inst., in his sixty-first year. He is best known in this country for his "Monograph on Conifers," in "De Cardolle's Prodromus," one of the best works on the subject extant.

Purchase of a Ross-shire Estate.—We understand that the lands of Rosemarkie, estate of Hawkhill, situated near the ancient borough of Fortrose, and lately belonging to Major Nicholson, who has for the present removed to Africa, have been privately disposed of to Mr. George Dunlop, merchant, Greenock, who is the proprietor of the estates of Ballinoe, Wellgreens, and Maryfield, in the parish of Kincardine, county of Ross.

Appointment.—Mr. Hugh Munro, late of the Caithness Saw-mills, Wick, has recently been appointed forester to the Earl of Leicester on his estate at Holkham, Norfolk.

A Wonderful Tree.—Adjacent to the city of Myobamba, Peru, exists a tree called *sami-caspi*, which possesses some remarkable features. It grows about 50 ft. high, and 3 ft. in diameter at the base, and has the power of absorbing an immense quantity of humidity from the atmosphere, which it concentrates and ultimately throws off from its leaves in showers, sometimes in such quantities as to convert the ground around it into a bog. Strange to say, this property is strongest during summer, when rivers are at their lowest and water most scarce. What a boon it would be at the present time for India, where thousands are perishing for want of water! *Sami-caspi* means rain-tree.

In the State of Illinois there are 334,067 acres occupied by orchards. In Great Britain there are only 150,526 acres.

The Price of Timber in Hants.—In North Hants and South Berks th timber trade is not so buoyant as it has been. Felled timber is more difficult to dispose of, and much of the timber which has been already purchased hangs heavy on the wood merchants' hands. Stripped oak is selling at from 10d. to 1s. 6d. per foot for trees averaging 7 to 18 ft. each. Of course the larger the average the better the price. Ash from 1s. 6d. to 2s.; beech from 1s. to 1s. 6d.; elm same as beech; larch from 1s. to 1s. 3d. Small trees of inferior quality 8d. to 10d.; Scotch and spruce from 9d. to 10d. These prices do not include haulage to the railway station.—*Largo Bay.*

Sycamore Timber.—The timber of the sycamore tree, *Acer pseudo-platanus*, is extensively employed in Lancashire in the construction of the heavy rollers used by calenderers and cloth-finishers, and when of a size suitable for that purpose, 18 inches or more of quarter girth, it is in much demand, and realizes good prices. The boles of four moderate-sized trees, containing in all 200 cubic feet of timber, averaging 20 inches in the quarter girth, were lately sold on the Earl of Wilton's estate, of Pilsworth, near Bury, at 2s. 6d. per foot, realizing the handsome sum of £25 for the four trees, without taking into account the limbs or large branches, which are used in the manufacture of bobbins, &c., and realize a paying price when sold for that purpose.—D. D.

Large Trees.—Attention has been directed to the extraordinary growth of trees in various parts of Scotland. At Springkell, in Dumfriesshire, says the *Dumfries Courier*, there are some remarkable silver firs. Twelve of the largest trees measure from 80 ft. to 115 ft. high, and girth at 5 ft. up from 10 ft. 8 in. to 13 ft. 9 in., their cubical contents varying from 180 ft. to 520 ft. A few years ago a silver fir at Southwick, near Colvend, Kirkcudbrightshire, was 159 feet high, 16 ft. 10 in. at 3 ft. up; and another on the same estate 134 ft. high, with a girth of 15 ft. 3 in. Besides these, there are several other fine silver firs on the Southwick estate about 12 ft. in girth. Though walnut trees never attain the height of the silver fir, their dimensions are not less worthy of notice. One of the finest specimens in Scotland is at Eccles, Dumfriesshire, and is 63 ft. high, girth at base 22 ft., and at 12 ft. up 13 ft. girth. Another at Gordon Castle, Banffshire, stands 66 ft. high, and 11 ft. in girth at 3 ft. from the ground; and at Altyre, Morayshire, there is one 62 ft. high, with a trunk 4 ft. in diameter. At Blair Drummond, Perthshire, there is one 75 ft. high and 13 ft. 7 in. in girth at 2 ft. up.

Poisoning of Cows by Yew.—M. Hartenstein records an important case of poisoning by *Taxus baccata*, as coming immediately under his own observation. Last April a herd of seventeen cows were driven a distance of twenty-four miles in search of fresh pasturage, the time occupied by the journey extending over eleven hours. On arrival at their destination the pasturage sought for was not obtainable, and for want of better accommodation the animals were placed for the night in an empty garden, surrounded by yew. In the morning the four finest cows were found dead, and three others died immediately afterwards; the remaining ten were quite well. On examining the garden the leaves of the yew bushes were discovered cropped all round. Post-mortem examination showed the bodies distended, the eyes dim, the nostrils clogged with blood and mucus, the liver literally looks as though it had been thrown into boiling water, and the small intestine for a distance of three yards almost black. The rumen was discovered full of green herbaceous matter, in which pieces of yew were easily recognised. It is supposed that the ten surviving cows, being older than the rest, had at once lain down to rest on reaching the end of their journey.—*Land and Water.*

The Scottish Arboricultural Society will hold its Twenty-fourth Annual General Meeting in the Lecture Hall at the Royal Botanic Gardens, Edinburgh, on Tuesday, 6th November, when the meeting will be presided over by the Right Hon. W. P. Adam, M.P., of Blairadam, the President of the Society, who will deliver an Inaugural Address to the members and others present at the opening of the proceedings. From the very excellent programme issued by the indefatigable Secretary of the Society, Mr. Sadler, the meeting is certain to be a very attractive one, and highly instructive to all who take an interest in forestry in however small a degree, and can make it convenient to attend the meeting. We should strongly urge all our readers, but more especially landed proprietors and their foresters, who are not already members of this most useful and perseveringly industrious society, to join its ranks at once, and assist the promotion of arboriculture in some tangible way, through the only association in the British dominions exclusively devoted to the advancement of the science and practice of arboriculture in all its varied branches. Under the present state of matters, when the Government utterly neglects British forestry, we look upon this Society more in the light of a *national institution* than merely an association of private individuals endeavouring to promote the successful culture of a race of plants in which they take a special interest; and for the valuable service it has rendered to forest science and practice during the twenty-four years it has been in existence, and the still more valuable aid it is likely to render in future, from its now flourishing state and rapidly increasing membership, it certainly deserves and ought to receive every help and encouragement from all those whose duty or pleasure leads them to take an interest in the culture of trees and arborescent vegetation.

Ever since the Society was instituted in 1854, it has annually published a valuable collection of papers on various branches of arboricultural knowledge, and practical essays on prescribed subjects, for which it offers and awards liberal prizes, and which now amount to eight goodly sized volumes of transactions, containing an immense store of thoroughly sound information upon all the varied subjects connected with arboriculture in its different departments, mostly written by practical foresters upon matters with which they are thoroughly conversant.

The valuable prizes offered from year to year by the Society for essays upon specified subjects, a list of which for the present year we published in our first number, has done much to call forth and foster a literary taste amongst the members, and has been the active means of adding largely to our hitherto very scanty store of arboricultural literature.

Filling such a useful and important position in the past, and accomplishing so much valuable work at times with great difficulties to encounter, and with, till recent years, a limited exchequer, we look forward with confidence to a brilliant future for the Society under the auspices and patronage of the landed proprietors of the country, and the active management of such well known and thorough arboriculturists as compose its council and office-bearers, presided over by such an able and eminent gentleman as the Right Hon. W. P. Adam, M.P., Her Majesty's late First Commissioner of Works.

We trust that arboriculturists and their friends throughout the country will make an effort to be present at the forthcoming Annual Meeting; where, besides the President's Address, which is certain to be full of interest, discussions will take place upon several subjects of much interest and importance to foresters; including the best kinds of Woods for making Charcoal, and the various methods of preparing it; Cryptogamic Plants injurious to Forest Trees, and the remedies against their attacks, &c.; and the eminent authority upon the subject of Forest Schools, Dr. J. C. Brown, of Haddington, late Colonial Botanist, and Professor of Botany in the South African College, Cape of Good Hope, will read a paper upon the establishment of a British School of Forestry, a matter of the highest importance in its bearing upon the future of British forestry, which cannot be allowed to rest until some satisfactory conclusion is come to commensurate with the times, and the urgent want throughout British dominions of a largely increased supply of foresters thoroughly trained in all the scientific, technical, and practical departments of their profession.

All information in regard to the object and aims of the Society, copies of the Laws, &c., may be had from Mr. John Sadler, F.R.Ph.S., *Secretary*, Royal Botanic Gardens, Edinburgh, to whom all com-

munications should also be made by any gentlemen desirous of bringing any subject of arboricultural interest before the meeting, or who may wish to exhibit at it any article of interest or importance to foresters; such as collections of cones, and seeds of forest trees grown in Britain; drawings or photographs of remarkable trees, or notable forest scenery; specimens of rare or curious woods; new or improved examples of foresters' tools and implements; or any other object that is likely to be interesting or instructive to a gathering of the leading practical and amateur representatives of arboriculture from all parts of the United Kingdom.

FROM the *Fifty-fifth Report of Her Majesty's Commissioners of Woods, Forests, and Land Revenues*, we glean some interesting information in reference to the profits derived from the timber, &c., produced by the Royal Forests and Woodlands, and the expenditure upon their surveillance and working. The report is for the year ending on the 31st March last, during which period the total receipt from Windsor Parks and Woods amounted to £5,509 18s. 6d.; and the expenditure for the maintenance of the same amounted to £24,587 1s. 11d. These figures include all the items connected with the management of the Woods and Ranger's Departments, and the Home Park; the receipts of the Woods Department for sales of produce, consisting of bark, poles, cordwood, fagots, &c., amounting to £2,115. The value of timber used for buildings, fences, &c., is £334 9s. 4d.; and the rents of land, cottages, &c., and various other receipts, £1,993 2s. 6d., giving a total of £4,442 12s. 6d. income from the Woods Department. The salaries and allowances in the department to the surveyor, clerk of works, foremen, and woodmen amount to £1,507 17s. 4d.; and the expenditure for new works, maintenance, management, &c., amounts to £18,395 4s. 2d.; the "new works" costing £3,366 12s. 1d. of that amount. The income from the Ranger's Department, including the sale of live stock, grazing rents, venison fees, &c., is £937 6s. The salaries and allowances to ranger, bailiff, parkkeepers, gamekeepers, gatekeepers, &c., amount to £2,571 6s. 4d., and the purchase of live stock, maintenance, and management entails an expenditure of £2,191 17s. 9d. The income from the Home Park is £130, and the expenditure £72 6s. 3d. It thus appears that the expenditure upon Windsor parks and woods exceeds the income from them by £19,228 13s. 4d., a large sum perhaps, but the country has the satisfaction to know that it is well expended in the thorough maintenance of such a splendid regal domain.

The expenditure upon the New Forest, Hampshire, for the same period, is, for planting, &c., including value of trees and plants removed from the home nurseries to the plantations, £1,239 8s. 2d.; for maintenance and general management there is a sum of £2,275 17s. 10d. expended for salaries and allowances to a deputy surveyor and three assistants, a clerk, seven foresters, eleven woodmen, constables, allowances for horses, &c.; the cost of labour, and material (including value of forest timber, &c., used) in maintaining the forest and preparing the produce for sale is £4,397 14s. 1d. To this is to be added the value of fuel wood assigned in the forest, the cost of machinery, implements, criminal prosecutions—a rather expensive item, costing £250 19s. 11d.; expenses of the sales and of forest officers, compassionate allowances (£270), destroying vermin, keep of hounds, cost of pheasants (£100), and other miscellaneous items, amounting in all to £1,074 16s. 3d., which makes the total expenditure for the New Forest £8,987 16s. 4d. The income from sales of produce, including timber, £106 2s. 6d.; bark, £1,814 15s. 3d.; poles, £4,135 4s. 3d.; cordwood, £62 10s.; fagots, £841 2s. 8d; fathom-wood, £217 4s. 6d.; miscellaneous wood, &c., £493 13s. 10d.; oak, fir, and holly plants, £84 6s. 8d.; and boat-crooks, £138 3s. 8d., amounting to £7,893 13s. 4d. The value of trees and plants removed from home nurseries to plantations, of timber used for lodges, fences, &c., and of fuel wood assigned in the forest being £461 4s. 6d.; the rent of cottages, with land and tilery, £580 7s. 4d.; forest dues and pannage, £152 5s.; and the fees for licence to sport over the forest £1,120: the total income from the New Forest being £10,207 10s. 2d., with a balance in favour of the proceeds over the cost of £1,319 13s. 10d.

The expenditure for the Dean Forest, Gloucester, is, for planting, &c., including labour, materials, plants, &c., £325 4s. 8d.; and for maintenance and general management, including salaries and allowances to officers, £1,850 1s. 6d.; labour and materials, £3,170 5s. 10d.; value of fuel wood allowed to foresters, &c., and other general expenses, £792 10s. 10d., making a total of £6,138 2s. 10d. The receipts from the sales of produce are—timber, £184 9s. 8d.; flitterns and saplings, £278 7s. 10d.; bark, £1,761 18s. 9d.; cordwood, £7,791 16s. 7d.; and miscellaneous wood, &c., £68 18s. 10d., amounting in all to £10,085 11s. 8d. The value of trees and plants brought from home nurseries to plantations, of timber used for repairs, &c., of fuel wood allowed to foresters, &c., rent of land, railways, &c., brings in a sum of £2,464 9s. 8d., making up a total income of £12,550 1s. 4d., which gives a balance in favour of the income over the expenditure of £6,411 18s. 6d.

The expenditure for High Meadows Woods, Gloucester, is, for planting, &c., £120 2s. 2d.; for general management and maintenance

£1,522 19s. 2d., making a total of £1,643 1s. 4d. The income from the same woods is — timber, £3,705; flitterns and saplings, £106 16s. 7d.; bark, £338 18s. 1d.; poles, £200; cordwood, £648 3s. 7d.; miscellaneous, £3 4s. 8d., together making the receipts from sales of produce amount to £5,002 2s. 11d., which, with the value of trees, &c., from nurseries, rents, &c., brings the total receipts to £5,377 12s. 10d., the income exceeding the expenditure by £4,734 11s. 6d.

For Alice Holt Woods, Hampshire, the expenditure is—for maintenance and general management, £632 16s. 9d., no planting having been done during the year. The income is—from sales of produce (saplings, poles, bark, cordwood, fagots, fathom-wood, &c.), £1,174 9s. 9d.; and from rents, shootings, timber, and wood fuel used, £552 15s. 4d., making a total income of £1,727 5s. 1d., which exceeds the expenditure by £1,094 8s. 4d.

The cost of maintenance and general management of Woolmer Forest, Hants, is £101 19s. 1d., no planting having been done here either. The receipts from sales of produce (saplings, fagots, and miscellaneous) is £474 1s.; the value of timber used for repairs, &c., £7 4s. 4d.; and the rent of land, £618, making the total income £1,099 5s. 4d., exceeding the expenditure by £997 6s. 3d.

For the maintenance and management of Bere Woods, Hants, there is an expenditure of £743 4s. 11d., and no charge for planting. The income from sales of produce (bark, poles, cordwood, fagots, and miscellaneous) is £1,580 2s. 10d.; value of fuel wood and timber used, and rent of cottages, land, &c., producing £157 13s. 10d. making a total income of £1,746 16s. 8d., which exceeds the expenditure by £1,003 11s. 9d.

The expenditure for Parkhurst Woods, Isle of Wight, is £272 8s. 11d.; no charge here either for planting. The income from sales of produce (bark, poles, fagots, boat-crooks, &c.), £387 3s. 9d.; and from the other sources, £33 5s. 6d., making a total income of £420 9s. 3d., the balance of income over expenditure being £148 0s. 4d.

The total receipts from the Royal Forests and Woodlands mentioned (exclusive of Windsor Parks and Woods) is £33,129 0s. 8d.; and the total expenditure £18,519 10s. 2d., which shows that they realized an income to the country for the year ending on the 31st March last of the respectable sum of £14,609 10s. 6d.

There is a farther amount of £4,322 14s. realized from the sales of timber produce on the Crown estates in the various counties of England and Wales, at an expenditure, so far as we can make it out from the mixed way in which it is given, of about £500.

These figures will give our readers some idea of the profits derived from our royal forests, which we believe would be very much increased

under improved and systematic management. In concluding our present remarks, we cannot but note the small amount of the produce of full-sized timber, and the very limited expenditure upon planting, renewing, and the improvement of the woods and plantations, upon which subjects we shall have something to say at a future time.

Our attention has been directed to a letter in a recent issue of the *Times,* in which Mr. Elliot, Clifton Park, Kelso, strongly condemns the reckless and ill-judged manner in which the conservation of the forests of our Indian Empire is conducted, and calling emphatically upon the Government to take proper and efficient means for thoroughly protecting the forests still remaining, and to see that they are judiciously and economically managed, and also to see that the raising and planting of trees throughout India is stimulated and encouraged wherever it is found they are necessary for the amelioration of the climate, the production of fuel, or for use in the arts and constructive economy.

The evidence in support of Mr. Elliot's impeachment of the neglect and bad management of the Indian forests by the Government is far too plentiful and clear to be easily refuted or denied, and now that one of the results of the indiscriminate sweeping away of the natural forests is being so strikingly manifested in the dire famine which threatens to decimate the teeming population of Southern India, it is high time that public attention was directed to the subject.

That the aridity and want of rain in many districts is directly attributable to the absence of trees or forests is now well known to be an indisputable fact. Many large tracts on the face of the earth, which have been clean swept of their clothing of primeval forest by the hands of careless or avaricious man, or by other causes equally fatal are now dry parched deserts, in which it is impossible to find upon the surface of their vast and dreary area a moist spot sufficient to produce even a single green blade of grass. On the other hand, it has been practically demonstrated and clearly proved that the planting of trees in a proper and judicious manner in districts which were previously destitute of them, and which in their treeless state were totally unfit for cultivation or for the production of food for man or beast, have been rendered thereby not only more healthy and habitable, but also under a proper system of good cultivation have been rendered highly productive of the crops peculiar to the country; in the production of which favourable change the trees have played by far the most important part, by their shade and power of softening the blast, and the influence they possess of attracting clouds and condensing

their vapour into genial showers, which water and refresh the forest itself as well as the crops of the husbandman on the cultivated land of the adjoining districts.

Such facts being so well known, and self-evident to all who take the trouble to observe them, it is truly lamentable to see how little they are appreciated or acted upon by the public or the Government; and the ruthless destruction of the forests throughout the British Empire is allowed to go on year after year, completely subverting the healthful balance of nature, without any really earnest and effective effort being made to remedy or check the evil. The little that Government has done, and that only in a half-hearted manner, through the means of the Indian Forest Department, is but as a mere drop in the ocean, and until there is a radical change in the system, which will throw life and energy into it, and entice properly qualified and energetic men to enter the service, matters can only go on from bad to worse, till drought and famine convert the fair and luxuriant plains of Hindostan into little better than an Asiatic Sahara.

An eminent statesman and Member of Parliament, Mr. Bright, speaking lately upon the calamitous famine with which a large portion of India is now so severely stricken, and to relieve which so much praiseworthy and generous feeling is being displayed in this country, rightly attributes the cause of the famine to the want of water, and strongly advocates the formation of a network of canals throughout India for the double purpose of transport and irrigation; but erroneously condemning the construction of railways as reckless waste of the resources of the country. Canals for transport in any country where railways can be constructed are utterly out of date, and only afford a receptacle for all the dirt and filth of the neighbourhood, producing and exhaling under a tropical sun an unlimited amount of poisonous fever-producing malaria, most unhealthy and detrimental to human life.

Canals for irrigation, and reservoirs for the storage of water, are highly important items in the industrial economy of such a thirsty land, and cannot be neglected with impurity; but of what use or profit can they be unless the water is first produced to fill them? The want of sufficient moisture in the soil and atmosphere is undoubtedly the primary cause of such terrible disasters as the famines from which India periodically suffers, and the best method of producing rain or moisture in abundance is by far the most important question to be solved in the problem of how to prevent the frequent occurrence of such direful calamities. The best and only practicable method known by which that object can be attained with a final certainty, is to *plant trees*, and to keep on planting and encouraging the extension of the woods, especially in the higher regions of the country, until such an extent of forest is produced as will restore

the climate to a proper equilibrium, and insure a regular and copious supply of moisture to the thirsty vegetation. The shade of the trees prevents quick evaporation, and allows the rain that falls time to percolate through the soil permeated by the roots, and to be stored in the earth as a natural reservoir, whence it is gradually given off through springs and streams, which in their descent to the sea water and refresh the country through which they flow, and provide an ample supply of water for irrigating, by means of canals, the cultivated lands at a distance from their course. To effectively carry out such a reformation, it is the duty of the Government, acting for the national welfare, to see that the right ground is selected for planting; the proper kinds of trees planted to suit the climate, soil, and demand; and the planting efficiently performed, so as to make sure of obtaining the desired result in as short a period as possible; and also to see that the after management of the forests is carried on in a thoroughly efficient and systematic manner, and that they are properly protected from all depredations, so that the annual average of the mature timber produced in them shall at least equal the consumption for all purposes, besides effectually maintaining the due proportion of forest to cleared land, so as to prevent the occurrence of long periods of drought and consequent famine.

For the efficient performance of such a national work, the first necessity is how to secure a sufficient staff of properly qualified foresters; men who know their business, and who have got their wits about them, with decision of mind to apply their knowledge and abilities with promptitude and energy, and a fixed determination to surmount all obstacles to accomplish the end in view. Such men are plentiful enough in the United Kingdom, and could be sent out to India by hundreds yearly, if only sufficient inducement was offered, and proper provision made for them studying in Britain the scientific branches of the profession; and this can only be done, with any approach to efficiency and completeness, by the Government establishing a properly equipped British School of Forestry, on some such substantial and permanent basis as has already been described and advocated in our pages. In such an institution the science and technics of forestry could be most efficiently taught to any number of students, in a manner far superior to any curriculum followed in the Continental schools, with the greatest economy to the students themselves, and at an immense ultimate saving to the State. All the knowledge of *practical* forestry that is requisite or necessary can be as thoroughly learned under any intelligent forester in Britain as in the most extensive "school" on the Continent. Such being the facts of the case, we hold that the present system of educating candidates for appointments in the Indian Forest Department is a sheer waste of

public money, as in the Continental schools they are only too apt to learn bad practice and worse habits, which it takes them years to unlearn after they get an appointment and settle in India, and which is the chief cause of much of the dissatisfaction that prevails, and the laxity and neglect in forest management of which the country has so much reason to complain.

During the past few years many of the more recently introduced Coniferæ have been adding a new interest to their charms in the artificial habitats they have acquired in the British Islands, by developing their beautiful and symmetrically shaped cones, thereby enhancing the peculiar beauty of their individual appearance, as well as affording to all lovers of this particularly interesting family an opportunity for studying nature's minute and secret processes of fructification and reproduction. The past season appears to have been peculiarly well adapted for the formation of cones throughout this country; and we have no doubt that at the forthcoming annual general meeting of the Scottish Arboricultural Society, to be held in Edinburgh on the 6th of November, we shall have ample facilities for admiring many varieties of cones, brought together by foresters from all quarters of the three kingdoms, like the grape clusters of Eshcol of old, to show the abundant fertility of their homes and country. In the meantime it is right that we should advert in the pages of this Journal to a recent unique exhibition of cones grown in the county of Kent, at Linton Park, near Maidstone, the seat of Vicount Holmesdale, by the intelligent forester and gardener, Mr. Malcolm Maclean, and which with characteristic good feeling, as well as patriotic pride, he contributed for exhibition to the recent horticultural show of his former Scotch home in East Lothian, held at North Berwick on the 14th and 15th September last, where the magnificent collection was highly admired by a large and fashionable company; and were deemed by all worthy of a place at any metropolitan exhibition where they would have done high credit to their exhibitor, and won fresh honours for Linton Park. The following is a detailed list of the specimens of cones, &c., exhibited:—

Abies Canadensis
„ Douglasii
„ Menziesii
„ nigra
„ Orientalis
„ morinda
„ excelsa
Picea nobilis
„ Webbiana
Picea Nordmanniana
„ pectinata
„ pinsapo
„ Cephalonica
Araucaria imbricata, branch, with cones of 1876 and 1877
Cunninghamia Sinensis
Pinus ponderosa
„ insignis

Pinus excelsa
„ Austriaca
„ sylvestris
„ pinaster
„ strobus
Cupressus Knightiana
„ macrocarpa
„ Nutkaensis
„ Lawsoniana
„ McNabiana
„ funebris
„ sempervirens
„ Corneyana
Juniperus recurva
Thuja dolabrata variegata
„ Lobbi
„ plicatus
„ Standishii
„ Orientalis
Thuja vervaineana
„ Wareana variegata
Retinospora pisifera
„ obtusa
„ leptoclada
Libocedrus Chiliensis
Cryptomeria Japonica
„ „ Lobbi
„ elegans
Cedrus Libani
Sequoia sempervirens
„ bark
Larix Europæa
Colletia horrida
„ Bictonensis, in flower outside
Liriodendron tulipiferum, seed pods.

THE eminent manufacturers of pruning-knives and other edge tools Messrs. Saynor, Cooke, and Ridal, Paxton Works, Sheffield, have lately introduced a new folding case or "Roll" of their celebrated pruning tools, specially designed for carrying in the pocket for use in the forest, nursery, or garden, and of which a sample has been submitted to us for our inspection. The "Roll" consists of a strong waterproof case, into which the different tools are securely fixed in the loops of a strap, so that the whole can be expeditiously folded up into a "roll" about ten inches long, which can be conveniently carried in the coat pocket. The rolls are made of two sizes, the larger one being specially designed for the use of foresters, and is fitted with a suitable set of tools, consisting of a strong stag-horn handle, having a powerful thumb-spring and socket, into which the various tools are inserted for use, and firmly held in their place by the spring; three sizes of strong well-shaped pruning-knives; a useful budding knife; a handy pruning saw for amputating branches of a size too large for being easily cut off with either of the knives; a capital pair of pruning shears for lopping smaller twigs; an excellent timber-scribe; a pair of nippers and a marking point; and lastly that generally appreciated article, a strong and useful corkscrew. The whole comprises a complete set of strong, well-finished, and serviceable pruning and timber marking tools, with which every forester ought to be furnished so as to be able to perform his work in the most expeditious and satisfactory manner.

The smaller roll is designed chiefly for use in the nursery and garden, and is fittedup with a lighter description of similar tools more suitable for the work to be performed, consisting of the strong spring stag-horn handle; six different forms of pruning, budding,

and grafting knives; pruning saw and shears; marking point, nippers, and the inevitable corkscrew; but there is no timber-scribe in this set, as it is not required in such places.

We have put the various articles through some severe and searching practical tests, and found them endure the trial to our entire satisfaction. They are made of the very best material, are neatly finished in a plain and serviceable style, and the cutting tools carry a smooth, keen, and lasting edge; so that we feel certain they will soon find their way into general use by foresters, gardeners, nurserymen, and others who may have either to mark, prune, bud, or graft a tree.

From various parts of the country we hear of a rapidly increasing interest being taken in all that appertains to Arboriculture, and the feeling is fast taking possession of all thinking and intelligent people that the science of Forestry has been sadly neglected by us as a nation. Among the many subjects discussed at the meeting of the Social Science Association, recently held in Aberdeen, was that of Forestry. Our talented contributor, Dr. J. C. Brown, of Haddington, read a most valuable paper before one of the sections upon the establishment of Schools for the systematic instruction of our young foresters in the science and practice of their profession. With a vast amount of collated knowledge of the subject, and a vigorous enthusiasm and a determined perseverance to carry the matter to a successful issue, Dr. Brown was listened to with rapt attention by the audience, while he ably discussed and advocated the immediate establishment of Schools of Forestry, so that we may not be altogether left in the rear by the rapid march of forest science in all the other civilized states of the world. Of Dr. Brown's views upon the subject our readers are already well informed, thanks to the able and instructive contributions from him upon this very important subject which we have at various times published; and we are pleased to mark the great influence that such earnest and persistent advocacy is bringing to bear upon the merits of the question amongst the press and the public throughout the country. The newspaper press being the best index of the feeling of the country, we are much interested in observing the laudable amount of attention many of them are now devoting to arboricultural matters, and the anxiety displayed by them to disseminate a true knowledge of the importance of a due proportion of forest being retained on the face of the earth for climatic and sanitary reasons, as well as for economic and constructive purposes.

When the press and people begin to view the matter in this

intelligent light there is good reason for hope that the Government will not much longer loiter behind in a matter that so deeply affects imperial interests and the material prosperity of some of the most important colonies of the empire; indeed, the preservation and renovating of their forests has already become one of the leading questions of the day in many of our Colonial Legislatures. We trust that the voice of the country will have its due weight with our legislators and all others whom it may concern, and that an early effort will be made to place British Forestry on an equality at least with that of the other leading European States.

THE United States are seemingly determined to outstrip the world in the lately awakened interest they are taking in the preservation of their forests, and the best means that can be employed for encouraging the planting of trees in those parts of the States which have been so ruthlessly denuded of them. Almost every mail brings us fresh news of some energetic movement being made towards attaining a full knowledge of the capabilities of the lumber-producing States, and their ability to supply the ever-increasing demand for timber, and of the praiseworthy endeavours that are constantly being made to obtain correct information about the best means adopted in European countries for the preservation and restoration of forests, with a view to its application in planting and restoring a due proportion of forest trees in the timber-denuded States. We extract the following interesting paragraph from a recently passed Act of Congress, and heartily commend it to the notice of all whom it may concern :—

"For purchase and distribution of new and valuable seeds and plants, sixty thousand dollars, provided that five thousand dollars of the above amount shall be expended by the Commissioner of Agriculture as compensation to some man of approved attainments, who is practically well acquainted with methods of statistical inquiry, and who has evinced an intimate acquaintance with questions relating to the national wants in regard to timber, to prosecute investigations and inquiries, with the view of ascertaining the annual amount of consumption, importation, and exportation of timber and other forest products, the probable supply for future wants, the means best adapted for their preservation and renewal, the influence of forests upon climate, and the measures that have been successfully applied in foreign countries, or that may be deemed applicable in this country, for the preservation and restoration or planting of forests; and to report upon the same to the Commissioner of Agriculture, to be by him in a separate report transmitted to Congress."

Cultural First Principles.

By G. S. BOULGER, F.L.S., F.G.S., late Professor of Natural History in the Agricultural College, Cirencester.

III. Theoretical Considerations as to the Treatment of the Soil.

(*Continued from page* 383.)

Having briefly considered the natural characters of soils, we will next discuss the treatment to which they should be submitted by the arboriculturist. I do not, however, feel competent to trench in this paper on the technics of forestry, which were admirably defined by Mr. King in the last number of the Journal. I wish merely to offer some of the considerations which theory suggests on this practical subject, and in doing this I shall not at present pause to define the relation of theory to practice, or to defend the former against the ignorant attacks occasionally made upon it by irrational and unthinking people.

The operations which we have to consider under the head of treatment of the soil are draining, trenching, ploughing, picking, and clearing. Manuring, rotation, and leaving fallow will be incidentally alluded to.

1. *Drainage.*—"In Scottish moorland more plants, perhaps, have been lost by being inserted into ground too wet than by any other cause, and it is seldom that any considerable extent of ground is found adapted for plantation without some parts requiring to be drained." (Grigor.) "To the want of draining may be attributed most cases of unhealthiness in plantations for forty years past." (Brown.) He refers especially to diseases of the larch. "As for draining, except in the case of stagnant pools, it must be resorted to with great moderation. A few ditches judiciously dug ensure sufficient drainage, for it must not be forgotten that our most valuable species delight in very moist and even wet soils, *e. g.*, the pedunculate oak, ash, elm, hornbeam, spruce fir, and alder. This has been sometimes forgotten. Whenever the water is not stagnant so that the soil does not become actually marshy, draining is a mistake. There is no doubt that the premature decay of the pedunculated oak in many places, and its disappearance in others, are due to over-drainage. This species is the tree *par excellence* of low-lying plains which are subject

to floods." (Bagneris.) "Draining of young plantations is a course of preparation that cannot safely be dispensed with." "Where the ground is naturally dry, light, and friable, such preliminary operations may be dispensed with; and, indeed, farther loosening or draining may, in certain circumstances, be detrimental rather than favourable to the plants." (Lewis Bayne.) The apparent inconsistency of these opinions is merely superficial. No one law can be laid down; we must consider the nature of the soil and situation, and the species to be planted. Sloping plantations will seldom require artificial drainage, as if the soil be light it will be sufficiently drained for conifers; if heavy, sufficiently for oak and the hardwoods mentioned by Professor Bagneris. Even on what is apparently a dead level it will seldom be necessary to drain a whole plantation. If the water is not stagnant in the soil so as to produce sourness, as may be the case even in sand, owing to a local stone or clay pan, draining will probably be unnecessary even for conifers. The growth of rushes, the wood-rush, (*Luzula*), the bog asphodel (*Narthecium*), a yellow star-like plant; the tufted hair-grass (*Aira cæspitosa*), or of mosses on the surface, are sure indications of the absolute necessity of drainage.

The breadth of drains at the bottom should never be less than a foot, to allow free spade-room, and across the top there should be one-third as much again as their depth, to avoid any risk of the sides falling in. For the same reason the fall ought never to exceed four in the hundred, so that on a slope steeper than this the drains must run diagonally, and not in the direction of the slope. Stiff soil will, of course, bear a greater fall than light or sandy, and will require the deepest drains and the greatest number of them. Three feet may be taken as the maximum of original depth, two as the minimum, but periodical clearings must deepen all drains as the roots grow deeper, so that five feet may well be their depth after fifty years. The minimum distance apart for drains is put at twenty-five feet, the maximum at fifty. All drains ought to be examined and cleared every two years, and the main drain yearly, so that the smaller ones may flush themselves. To secure this, two drains meeting should form an acute angle pointing in the direction of the flow; three drains should never meet in one point, and the bottom of the lower ends or outfalls of the small drains should be a few inches above the bottom of the main drain.

Main drains must, of course, be made in the lowest part of the ground, which it will be necessary to determine by the use of the spirit level in draining ground which is apparently a dead level. They must increase in size on receiving additional small drains, and their general capacity must be regulated by the amount of water likely to be poured into them in time of floods.

It should be borne in mind that the roots of conifers do not penetrate so far as those of hard woods.

2. *Ploughing, Trenching, and Picking.*—Of these, of course, trenching is the most expensive, picking the least so. I am inclined to agree with Mr. Bayne as to ploughing to a depth of fifteen or eighteen inches, as against the opinion of Brown, that it has an over-stimulating effect, rendering timber softer and shorter lived. I doubt if this can be proved to be the case. Where the soil is shallow, owing to the existence of a pan, the latter must, if possible, be broken up, and trenching may be necessary for effectually doing so; but I cannot think Mr. Bayne would advocate its general adoption in planting for timber on a large scale, with proper sized nursery plants. The utility of trenching, in the case mentioned in the letter in the *Journal of Forestry* for October, from "The Squire's Old Gardener," may have depended on the stiffness of some of the ground, and the stone-pan in other parts, though I by no means deny the protection from scorching or freezing afforded to very young trees by a previous preparation of the soil. I am, however, inclined to believe that ploughing eighteen inches deep is all that is generally necessary. From the discussion in this Journal it seems as if "tonite" may be safely asserted to be, on the whole, the best explosive for general use, from its strength, cheapness, and safety, in clearing land of boulders, tree-roots, &c.; and I think "Experience" is probably right in recommending the use of electricity for exploding it, at least where the area is of any extent. I believe the Leclanche battery is the most economical.

From the fact stated in my last paper, that the greater part of the lime, silica, potash, soda, magnesia, and phosphorus is returned annually to the soil by the falling leaves and fruit, I am inclined to agree with Brown that, when once the most suitable species for the soil has been fixed on, rotation is hardly worth considering. This is only true, however, where leaves and fruit are left to natural decay, and where the function of a rotation is in part fulfilled by letting cleared land lie fallow, that is, exposed to the "weathering" influence of the atmosphere, as Brown recommends, for four or five years. Land should be ploughed before being left as fallow. The natural manuring of decaying leaves and weathering is all that is advisable economically or physiologically for timber. In this I quite agree with Brown's opinion, that all else is a harmful temporary excitement of the young trees, only tending to render their timber ill-matured.

On the Acclimatisation of Foreign Timber Trees, and the Introduction of Foreign Woods.

By JOHN R. JACKSON, A.L.S.,

Curator of the Museums, Royal Gardens, Kew.

While the introduction and acclimatisation of useful plants into India and the colonies has occupied, and is still occupying, considerable attention, not only amongst practical but also amongst scientific men, it is a fact that but little is really done towards introducing, or rather prosecuting, the cultivation of new products in this country. Occasionally we hear of a new fibrous plant, a new vegetable, or a new fruit, but after the first outburst of glorification awarded to it, not only the product but the plant itself often disappears, to be heard of again, perhaps, in another decade. It is true that many of the introductions of past years have been natives of tropical, or at least of warmer countries than our own, and as such stand but a poor chance for general cultivation here. The south and west of England and the sister country, Ireland, have mostly been advocated as suitable for extensive experiment in this way, but British crops, whether of field or forest, remain pretty much the same as they were at the beginning of the century. With regard to forest produce, which is the point upon which we are more particularly interested, we cannot refer to any recent startling introduction of great economic value.

Without professing to know anything of practical forestry, it seems to us that the introduction and cultivation of useful and ornamental trees are points that do not receive sufficient attention. We may glory in our "brave old oaks," our noble elms, Scotch firs, larches, and other well known British trees, and we should by all means persistently plant them, that England's forests may continue to be in future generations what they have been in the past; but for the sake of variety, for picturesque effect, as well as with a view of providing a home supply of some of the fine foreign timber we occasionally see in special collections, it is desirable that trees of other climes should be more extensively planted in this country than they are. A great deal of attention is at the present time paid to purely ornamental plants, shrubs, and trees, for the embellishment of the lawn or shrubbery, and if we think for a moment of the arboreous riches of the great continents

of America or Australia, to say nothing of other parts of the world, we shall at once find no lack of individuals worthy of serious attention.

Many of the trees of the former country are well known to us, and not a few fine species of oak, as well as of pines, maples, and others, might be more extensively planted than is the case at present. The woods of all these are valuable for structural and ornamental purposes. With regard to Australian trees, there are, as most of our readers know, an endless variety, many of which are of gigantic proportions, with a great diversity of foliage, and producing hard and variously coloured or figured woods. A good notion of these may be had from the splendid collections from the several Australian colonies contained in the No. 3 Museum at Kew. Whether we look to the numerous species of eucalyptus, some of which attain in their native home colossal proportions, and have moreover of late obtained a world-wide reputation, or to other myrtaceous and leguminous trees, foremost in which latter family are the species of acacia, we shall find many well worth attention both as ornamental and useful timber trees, and even those species which are not capable of acclimatisation with us should be known in the timber trade by their woods becoming recognised articles of commerce. The rich colours and splendid veining of the woods of many of the acacias are of such a character as is not seen in any other known wood. The refreshing perfume of the myall or violet-wood is another special character, the sawdust of which might be utilized by the perfumer for sachets. The hard nature of the woods of the eucalypti before referred to is well known, and this, added to their rapid growth, would make the trees invaluable, where they could be induced to thrive.

We cannot conclude these remarks without drawing attention to one tree in particular, which may be well known to many of our readers, but the beauty of the wood of which we believe is really but little known. We allude to the Huon pine of Tasmania (*Dacrydium Franklinii*). The splendid markings of this wood are, we believe, alone in their peculiar character, and a carefully cut slab of Huon pine is certainly not to be surpassed, if equalled, by any other wood. In proof of this, we need only point to the fine slabs in the No. 3 Museum at Kew.

These few remarks will, we hope, lead to greater attention being paid to the acclimatisation of foreign trees in this country, and to the more extended importation of really useful and valuable foreign woods.

On Planting.

By ALFRED J. BURROWS, Pluckley, Kent.

(*Continued from page* 389.)

In commencing entirely new plantations upon the sea-coast, with a view to affording shelter inland, it will in most cases be necessary to erect a tolerably compact fence either of stone—if such can be easily obtained—or of soil. Where the latter is used the mound should be of sufficient width to take two or three rows of whitethorn upon its summit. If its height be from 4 to 6 feet, it will to some extent intercept the passage of the saline particles with which the air is charged, and which prove so fatal to vegetation in the earlier stages of its growth. Behind this "lew," or shelter, may be planted well-furnished trees of the cluster pine *(Pinus pinaster)*, which is well adapted for such a situation, as its tap-root penetrates to a great depth in the sand or soil, and sends out strong lateral shoots, from which proceed great numbers of rootlets, so that it soon takes complete possession of the ground; and though it is not adapted to high and exposed situations, it will grow freely upon most parts of our coast.

In some districts of France, particularly on the coast of Gascony, between the estuaries of the Gironde and Adour, it has been successfully used for fixing the dunes, or moving sandbanks, which were rapidly encroaching upon the land. For this purpose its seeds are sown in connection with those of the broom and furze. Its wood has proved to be so valuable that it is now extensively used in the south of France and in some parts of Spain for railway sleepers, and found to be very durable. In its natural habitat (in warm or mild climates) great quantities of resin are drawn from it by tapping, for which purpose the trees are carefully prepared by thinning, and by exposure to as much light and heat as can possibly be obtained. Its branchy nature and bushy habit of growth render it very valuable in the front lines of coast plantations.

Along with the cluster pine may be planted Norway maple, in the proportion of one to three; also an admixture of willow, sycamore, abele, evergreen and Turkey oak, and even Austrian pine. The sea-buckthorn and mahonia are also valuable as undergrowths in the front lines. In its native country the Norway maple grows close down to

the sea, and even attains large dimensions in such a situation. Its wood is closer grained than that of the sycamore, and takes a higher polish when used in household furniture, or for making bowls and trenchers.

One effect of the sea breeze upon vegetation is that the trees rise gradually from the shore like the roof of a house, and do not attain their full altitude for some distance inland. Their heads are thus more or less flattened, and become very dense. This necessitates careful thinning, so that the plantation shall break and soften the winds instead of directing their full force to the higher trees. For beyond the reach of the direct action of the saline matter the air is softened and mellowed, and vegetation flourishes.

In the reclamation of bog or mossy lands, for the purposes of the planter, the first consideration is thorough drainage, which can be effected only by good open ditches at intervals of not more than thirty feet, and at depths proportioned to the thickness of the moss. Where this is not more than five or six feet, it is better to cut completely through it, and give the drains the benefit of a firm bottom: and as the shrinkage or subsidence after the loss of water is great—sometimes amounting to more than one-third of the entire thickness—there is no fear of the drains being too deep. During the second year after the completion of the drainage the surface should be pared off to the depth of several inches by the common paring plough, and burnt after being completely dried. If the sods will not burn readily, the addition of a little furze or other light fuel will generally give a start. The danger, however, lies in over-burning, as by this means all their virtue as manure for the young plants is lost. As soon as they tumble to pieces, and the ashes assume a red or yellowish hue, the firing should be stopped. If the operations of paring and burning the whole surface be considered too expensive, the work may be done in strips, or even confined to the more immediate vicinity of the holes themselves.

Upon all moss lands holing before planting is essential to the sweetening and proper preparation of the soil. It also prevents the cracking of the surface and the exposure of the roots in a dry summer, which is no unusual occurrence where the plants are notched in. If the holes are dug five or six months before planting, so much the better for the future crop. Either before, or at the time of planting, the ashes of the burnt sods should be well mixed with the soil in the holes. Upon mossy lands where there is great poverty of soil it will be advisable to plant larch alone at distances of from 2½ to 3 feet: these may afterwards be thinned out for the reception of other trees as soon as they are large enough for use. In filling up for his final crop, the planter must here as elsewhere be guided by the

situation and the quality of the land. Where vegetable matter preponderates, and that to a great depth, spruce and Scotch fir will answer. In high situations, and where there is a large per-centage of siliceous matter, the Scotch fir is alone adapted, or it may be planted in conjunction with the birch, both of which flourish at almost any elevation. Where the moss is largely mixed with other substances, and rests upon a sub-stratum of clay, the usual mode of planting moist situations may be adopted, using the cluster pine, Scotch spruce, and silver fir, poplar, and willow. Where proper drainage cannot be insured it will be best to depend mainly upon the alder, birch, willow, and poplar. Upon shallow mosses, with a good bottom, the elm and ash will flourish, and even the peduncled oak sometimes attains good dimensions. To keep down weeds, close planting and a little timely attention will be necessary.

In situations where it becomes necessary to plant for a permanent screen, the spruce and silver firs make a good front line, as their leaders may be shortened so as to secure greater density of undergrowth. Immediately behind these should be a breadth of such coppice wood as is best adapted to the situation, and which should stretch back and intermix with the belt of high trees. By cutting down one-half the breadth of coppice wood every five or six years a regular blind is secured.

Upon the banks of streams, or in other wet situations, where the expense of fencing is not considered desirable, an effective screen may be obtained by driving in stout stakes of alder, as the bitterness of the foliage generally secures it from the browsing of cattle and sheep. The sallow, or common white willow *(Salix alba)*, may also be used for the purpose; but of it, tall poles of six or seven feet in length should be selected, so as to place the shoots beyond the reach of cattle and horses. Both kinds grow quickly, and afford great protection to the banks by defending them from the denuding action of currents. The wood of the alder is valuable for making gunpowder, clogs, and lasts; and when of large dimensions, for piles.

From the commencement of a plantation it is always necessary to keep in view its ultimate extent, and so dispose each part as to secure in the end one harmonious whole. In order to accomplish this it will be necessary at the beginning to lay down a good working plan, from which there should be as few deviations as possible. Though variety in all plantations is highly desirable, yet the heterogeneous admixture of all hardwoods, irrespective of their habits of growth, methods of treatment, and adaptability to the soil, is as wrong in principle as it proves disastrous in practice. To plant in this way, under the plea that a full occupation of the ground is thereby secured, is an act unworthy of the skill of the modern forester, who

ought not to depend upon such remote chances of success, and whose habits of observation should enable him to make choice of proper plants adapted to the locality; nor is it necessary to apportion the space available for planting with the regularity of patterns of a wall-paper or a carpet, as nothing can be more repugnant to correct taste than the recurrence at regular intervals, and with mathematical exactness, throughout a large mass of woodland, of the same forms and tints the whole season through.

One point which deserves the consideration of all planters is the judicious admixture of deep-rooting and surface-rooting trees, as by adopting this method a more complete occupation of the whole soil is secured. Another is the necessity of thoroughly clearing the ground of all remains of its former vegetation before proceeding with new plantations upon old forest or woodlands. By such means alone can the destruction of insects injurious to the timber be secured.

The value of the spruce and silver firs as nurses and screens is often underrated; for where they have sufficient space they retain their lower branches even to old age. By shortening the top they may be made to afford good bottom shelter, and the spruce may even be clipped into a compact hedge. Its protection during the earlier stages of its growth far exceeds that of the Scotch fir, and it will develop a good bottom in about one-half the space required by the latter. The growth of the silver fir is slow at first, but after the age of nine or ten years it shoots up rapidly.

In an article specially devoted to planting it is unnecessary to make more than a passing allusion to the connected operations of fencing and drainage, without which in most situations the planter's labours are thrown away. A thoroughly secure fence, impervious to sheep, cattle and horses, is the first consideration. The advantages of thorough drainage are numerous; for besides opening up the soil to the beneficial influences of the atmosphere, and of high temperature, it removes many substances injurious to vegetation, and by breaking through the almost impenetrable pan which forms in all soils at a greater or lesser depth, it permits the escape of superfluous moisture during a wet season, and enables the roots to penetrate to a greater depth in search of food. The increase of temperature which follows thorough drainage of very wet land is seldom less than ten degrees, and sometimes as high as twenty. By its influence trees obtain an earlier start in spring, make larger growths of wood during the summer, and as the soil retains its heat till late in the autumn, the new wood becomes more thoroughly matured.

Purely ornamental planting comes more immediately within the scope of what is called landscape gardening. In this department great advances have been made during the present century; but we

still meet with so many instances of utter disregard to the *genus loci*, or requirements of the situation, and such want of judgment in locating trees of large growth, that we miss the hand of the experienced forester, and find that where the judgment of a consulting physician was required, the work has been entrusted to an apothecary. Happily, however, we have outlived the age of formal rows of clipped and contorted trees, which in their stiffness afforded a fitting background to the pedestals upon which were to be seen, surrounded by

> "Heathen goddesses most rare,
> Homer, Plutarch, and Nebuchadnezzar,
> All standing naked in the open air."

The art of transplanting, or the removal of large trees for the purpose of producing immediate effect, inasmuch as it requires appliances in machinery and tools beyond those used in the ordinary operations of the forester, requires to be separately treated. Under the fostering care of Sir Henry Stewart, it assumed important dimensions and attracted considerable notice. His success was undoubted, and his practice as novel as it was startling. His operations were conducted upon true scientific principles. The tree intended for an exposed situation was carefully selected, and gradually cleared and opened out, until it became hardened enough for removal. No unnecessary trimming of roots or pollarding of the head was allowed; and, contrary to the present practice, what had been the leeward side in its former situation was placed to the windward in the new position. The result of this was most satisfactory, as the trees required no artificial support of any kind. Mulching formed an important part of their after treatment, and watering and ramming at a later period. The present practice of deluging with water every transplant is open to grave objections. Its strongest advocates appear to have sat at the feet and imbibed the ideas of the philanthropic Count Romford, who, in experimenting upon the food of the poor, made the economical discovery that water contained a considerable quantity of nutritive aliment. Sir Henry's success supplied a practical answer to the question of Macbeth,—

> "Who can impress the forest—bid the tree
> Unfix his earth-bound root?"

(*To be continued.*)

Technics of Forestry.

By J. CHARLES KING.

No. II.

(*Continued from page* 393.)

In forestry, as in other handicrafts, Science, the handmaiden of Toil, investigates, fashions, forges, and formulates the tools and methods the foresters use, now, as it did centuries ago, be the tools of stone, bronze, steel, or the electric wire; science has to be subordinated to the limits of muscular action in the fitness of its diverse application in aiding technical aptitude of hand, eye, or brain.

The tools of the wood-hewers of former times have been found to differ but little from some in use now, and in the matter of simple form, some display a fitness which commends itself to workers before some of the misshapen fanciful ones made by the gross, by workmen who are obviously ignorant of their use, for employers who are equally ignorant and indifferent to everything but the profit upon their sale. Thus we see that science ceases to be sense the moment it deviates from fitness of application in aiding muscular action or technical effort.

The import of these remarks will be obvious to many who use bills, saws, and axes for felling and lopping timber, and the illustrations of such tools for hard close-grained timber will be thought strange by some woodwards who have been accustomed to soft wood tools only, which will be illustrated in due course, though the diversity of some may be but slight.

By reference to the illustrations in the October number of the *Journal of Forestry* the "bill" is shown to be made of one piece of steel, the "haft" end being rolled up into an open pipe or socket, 1 inch inside diameter, and 1½ inch long at the part that is welded together; the action of forming a tube out of the flat surface of a blade makes a part of it in front of the socket for about 1½ inch form a hollow bulged out of the blade, into which the handle fits through the socket. Here at once is a passing illustration of the fitness of a tool in form for muscular effort; looking at the back of the "bill," No. 2, that part which forms the semi-elliptical hollow into which the wooden handle is socketed exactly fits the fork of the thumb and finger of the right hand when the bill is held at that part, as it is for many of the lighter operations of woodwork, barking, skimming

off shoots, &c. The muscles of the thumb and forefinger are not unduly distended in grasping this part of the bill, and its freer play in the hand aids the flexibility of the wrist. Grasping a bill thus is termed "holding short," or "home," and is quite distinct from the full-handed grasp of the handle close to the clutch-knob for the swinging stroke from the shoulder.

The handle is preferably of ash, which, of course, must be of seasoned timber; it is shouldered at its insertion in the socket, so as to form a smooth hand-piece, level with the surface of the socket and face of the blade: a small clout-headed nail, as shown in No. 1, keeps the handle securely in the socket. The spur at the back of the bill serves for gathering up, or drawing towards the woodward's left-hand grasp, any branch that may have to be reached for cutting or moving aside. The notch at the end of the bill, formed by the angular projection of the cutting point of the bill, and the spur, serves for thrusting aside a branch, or aiding the force of the left hand in its movements.

A bill for hedging and ditching work is of the same shape, but two inches longer, and heavier; this is of iron, with a steel edge "laid on;" being of iron, it is made nearly one-eighth of an inch thicker at the back edge, not only for strength, but for use, in driving the forked stakes into the banks for tying down the "plashings" and shoots.

For hedging, the angle notch at the end of the bill is constantly in use for thrusting down shoots, or small tie-stakes, and for forcing branches aside, or into position. A dexterous woodward often uses the butt-end, or clutch-knob of the bill, for driving a tie into a bank. The human hand is admirably formed for using a bill without injury by jar or fatigue; in cutting, the stroke may either be directly downward, or upwards, this is called a back-handed stroke, the back of the hand being towards the user; in either case the stroke has the effect of contracting the thumb and finger muscles, by the pressure of the bill-handle between the thumb and finger; in like manner, the pressure on the hand between the wrist and little finger contracts those muscles, aiding the grasp of the handle of the bill: the strain upon these muscles is very great; when excessive, often causing a permanent contraction of the muscles of the little finger and next, in workers who have to grasp tightly the tools they use. A flexible arm will deliver strokes with the greatest exactness.

Writers of fiction, and some who think they write facts, speak of the "*turn of the wrist*,"—it is accepted as a fact by readers in general; but it is not so; the wrist admits of but slight power of turning; it bends pliantly backwards and forwards, but it is the fore-arm that twists, between the wrist and elbow.

The axe is associated with the woodman's craft, and is regarded as

the typical emblem of his toil. To the majority of writers for the press and scribblers of "information for the million," and "popular educators," an axe is a chopper of some sort for cutting wood; that is about the extent of information they condescend to impart. Perhaps it is as well: concealed ignorance does least mischief. Artists, unless as accurate as Leonardo da Vinci of old, or Morland, Wilkie, Herring, and Hunt of recent times, depict axes according to their fancy, often but sorry displays. Constable and Turner, and similar colourists, were very deficient in technical accuracy. With photography to give reflex exactitude, there is no excuse for artists' blunders; the reason for the more correct delineation by old painters may be assumed from the fact that they at some time used the tools they painted. Leonardo da Vinci, the prince of painters, was an art worker. There exists a painting of singular merit of this artist stripped, with bare arms, at a blacksmith's forge,—perhaps about to forge an axe. The blacksmith has put on his coat, and sits on an opposite anvil, with a wicker-covered flagon of wine and drinking-horn in his hands, watching the artist about to forge some ironwork; one of the blacksmith's boys is blowing the bellows, and the wife and two other children are spectators of the painter-blacksmith, who it is known could forge a horseshoe, and by sheer strength of arm and hands could straighten it out. But to return to the woodman's axe, its illustration No. 3 shows its best form of construction for hard woods:—oak, ash, beech, elm, hornbeam, walnut, chestnut, &c., of the temperate zones, or for the harder woods of the tropics and Australia, as may be noticed in illustrations of axes used by the wood-hewers of those regions.

The head is shown to be a pear-shaped ellipse, the crown being twice the thickness of the sides of the elliptical head. This is essential, not only because the head of the axe is used as a sledge-hammer for breaking off or down a piece of timber, driving a wedge, &c., but to resist the strain on the head when used properly as an axe. If the head be thin at this part, the jar will cause a fracture here. This is the part, in this shaped axe, where the iron is welded together to form the eye of the axe. The length of the head from back to front is but little less than that of the cutting edge from "point" to "heel," so that the handle has a very secure fixture in the head, and is not liable to get loose if well fitted in,—for it must be fitted in well, and be driven in not too tightly, or the head will be opened at the slit of the oval. An iron wedge is driven into the end of the handle, at right angles to the axe-head, as shown in No. 4; it is not wide enough to touch the iron anywhere: this wedge is about two inches long, and is mostly jagged at the edges to make it hold well into the handle.

The cutting edge of the axe is of steel laid on (as the term is for

welding steel on to edge-tools) for about two or three inches; this is done after the axe is forged or shaped out, and is the chief art of axe-making, and both the woodward and blacksmith know it to be so. The woodward will often wait while the job of re-laying an axe is done, giving a hint of what he wants. The blacksmith will explain that he cannot do a job like that without a "clean fire," which is freedom from sulphur, with which coal is charged: this prevents the flux of steel and iron, excess of heat making the steel melt and crumble away; or imperfect and uneven distribution of the hammering will deteriorate the steel, to say nothing of making a bad "scarfe," showing where the steel and iron should blend without a mark or seam.

When East Kent was a large iron district the Kentish axes had a fame everywhere; the forging being done by wood fires preserved the purity of the steel from sulphuric acid gas; and the blacksmiths of the present day in these parts succeed in making and tempering axes to perfection. In tempering, the steel part is made of a bright cherry-red heat, and plunged into cold water; this crystallizes the steel to intense brittleness. This crystallization has to be destroyed slowly by heating the axe, thus, making the head nearly red-hot, and letting it cool gradually, and watching the colour the steel gradually assumes where the scales of the surface have been filed or rubbed off. First a very faint straw-colour is visible at the cutting edge; this becomes full yellow, then brown with purple spots; now the axe is plunged again into water, and the hardening is done.

This heating of steel changes the crystals that form its molecular structure into stringy fibres, which are fixed at their density by chilling when the purple spots appear on the surface. Hard steel needs more "lowering" than soft steel; then the purple spots become diffused into a purple all over. The softer the wood, the harder the axe may be. Because a man may be a smith, he may yet not be able to make an axe, any more than a forester may be a woodward, though he may have handled an axe for years.

The sharpening is done by grinding two bevils, forming a cutting edge; these bevils are concave, formed by the convexity of the grind-stone, which is made to revolve *to* the cutting edge; if it were turned *away* from the edge, it would drag the steel to the edge, leaving it ragged, even forming a fine strip of ragged steel on the edge, known as a "wire edge." The illustration No. 3 shows the edge of an axe as left after forging; the grinding is carried further up the blade, making the angle very acute, but still leaving the faint ridges B No. 3 well defined. These give the axe easy clearance when bedded deeply in the heart of hard grained timber, and make the chips fly from the strokes, by breaking the grain of the wood; without these the grain would be only bent.

In directing the forging of axes, and grinding by smiths' and woodwards' lads, I have asked them to hold the axe so that this ridge was not blurred out in grinding—the same as a cleaver. With a critical sense of hearing I could, without looking, tell if an axe was being ground properly, correct grinding producing the sound "eth," by which term I designated these faint angles left by grinding. When sharpened, so that the woodward can pare a piece of skin off his horny hand with its keen edge, it will stand any fair work, even to cutting a spike nail in halves if bedded in the tree, and not turn the edge of the axe; but with a loose scrap of iron, a blow would notch the edge at once, but if well embedded in hard wood, the same as ironclads are backed with teak, the axe will go through the nail as easily as a shot will go through armour-plating; but will fail to do so if the teak backing is removed.

The terms for handle vary in different counties, "helve" and "haft" being the next most familiar terms. Ash is generally used, being light, tough, and cool to handle, and by its smoothness not abrading the skin of the hands.

The eye of the axe is not parallel, but slightly convex; this favours the tightening of the handle by wedging; sometimes a wooden wedge is driven in on the line of the eye, and the cross wedge of iron driven in as shown afterwards, but the less wedging the better for the handle; as the cross section of the end of the handle shows more wood to be expanded from the slit to the head of the axe, the wedge is best driven in crossways. An axe-head invariably gets loose in that direction, and not sideways, the strain from the handle in wrenching an axe out of a cleft being in the line from edge to head. The handle is driven through the eye a little as use loosens it, and the wedge is driven farther in to tighten the handle. The handle is left larger for two or three inches near the head, as it gets chipped about here pretty much in use. The handle must be quite straight, and straight grained, and taper slightly up to the clutch-knob, which is much smaller than that of the bill-handle. From 3 feet to 3 feet 4 inches are common lengths.

(*To be continued.*)

About Chemistry of Paling Rails.

By ANDREW TAYLOR, F.C.S.E.

The forester, no less than the chemist, is constantly watching experiments. The student in the house makes oxygen by fusing together chlorate of potash and bi-oxide of manganese. The complaints of your correspondents about the decay of paling rails, stobs, &c., is really the recording of the fact that a slow burning is going on, caused by the oxygen of the atmosphere uniting partly with the hydrogen of the woody tissues to form water, or with the carbon of the same organisms to form carbonic acid. The full effect of this slow burning is seen in the formation of the humus of the soil, but decaying wood is as certainly caused by this natural process. The problem is, then, how to prevent the oxygen of the atmosphere gaining access to the lignary tissues.

Now observation and theory teach us so far; and it should be the aim of practice to find how best to give practical effect to such teachings.

Wood altogether covered from the action of the atmosphere is practically perpetual. M. Peligot examined a portion of resinous wood which formed the quay of Carthage, and which was built about the year 860 before Christ. In colour, texture, and fibre it was like ordinary wood cut just now. It had been, however, subjected to the process of fossilization by infiltration. It contained 80 per cent. of mineral matters, notably carbonate of lime to the extent of 47 per cent., and 8 to 10 per cent. more carbon than ordinary wood. It was thus simultaneously changing into a limestone and a coal. When wood is, however, immersed in stagnant water, decomposition is much more rapid. In sixty-five years the fibres have become disintegrated, and the mass gradually changing into a substance like peat. This has doubtless arisen from the gases held in solution by such marshy waters.

It is quite open, then, to the forester to fossilize his paling stobs, either by placing them in natural waters containing much carbonate of lime, as those of Lough Neagh, or the encrusting springs of Matlock, or by injecting into the pores such chemical solutions as sulphate of copper, &c., as is done in France. But these do not seem to be appropriate for the minor details of rural economy. Let me only say

that when coal-tar is used, it is partly this process, and partly that of an ordinary drying paint, where an outer coating protects the ligneous tissues from atmospheric oxygen. Coal-tar has a certain drying power, paraffine oil or petroleum has not; but, on the other hand, these oils contain solids which infiltrate into the vegetable cells, preventing chemical reaction. A recipe given in a recent number looks more an exemplification of the principle that there can't be too much of a good thing than a scientific method.

The objections of M. Boucherié to the gallo-tannate of iron process have a scientific foundation. No one doubts the preservative power of gallic and tannic acids. It were to forget all the oak stumps from innumerable peat bogs, black as ebony, but perfect as the day on which they were immersed. Those old trees have not been exposed to the immediate action of the atmosphere. But the posts used either for telegraphic purposes or the harbour works, seasoned by Boucherié's pyro-lignite of iron process, show very different results. M. Kuhlman has proved long ago that whenever iron in the state of union with oxygen known as the protoxide enters wood a curious chemical reaction ensues. The protoxide becomes the peroxide by taking more oxygen from the atmosphere. But the iron is immediately robbed of the oxygen it has newly acquired, by the compounds of the wood. They do not long retain the stranger oxygen atoms they have captured, for water and carbonic acid are both formed, and so the wood decays. Moreover so long as the iron remains in the wood these processes are perpetual. Fresh oxygen is seized from the air so soon as that first captured disappears, and consequently the decay of the wood continues. But though pyroligneous acid by itself is an excellent preservative, it has been found when associated with its bad neighbour iron protoxide to have a prejudicial effect; so, too, of all similar iron compounds.

After all, a partial burning of the wood prevents the access of oxygen into the interior. M. de Lapparent has introduced this method into France. He has invented a lamp fed by tar and petroleum, which effects this semi-incineration very cheaply and expeditiously. There seems no reason why our British lamp-makers should not supply such a lamp specially adapted for railings and paling stobs. French experience shows this method of wood preserving to be admirable. Inventors should easily see how this can be conveniently applied. Paraffine heavy oil, at present very much a waste product, could be used, and a jet of steam directing the flame into the cylinder containing the wood is all that is necessary for a quick and efficient flame.

Protecting River Sides.

By W. LIPSCOMB, Heath, Wakefield.

It is no uncommon thing to see on the sides of rapid running rivers very costly experiments in the way of protection against floods entirely fail in arresting the damage done to the banks; or if they succeed at the particular spot on which the barrier is erected, fresh mischief is created by the reflux of the stream a little below this point.

Having successfully arrested most serious inroads made by such a river, I will point out the principle which I have adopted. The ordinary method, where land has been washed away, is to erect jetties just above the breach, and inclining at an angle *with the stream.* I know of scores of such projecting weirs, or jetties, composed principally of stone, but I have never seen an inch of land recovered by them, and unless they are repeated at close intervals fresh breaches will be made lower down. I have found that making the weir *below the breach*, and inclining it upwards, *at an acute angle to meet the stream*, is an unfailing expedient, both for recovering lost land and stopping further mischief anywhere near the point protected. The materials I have used are boughs of trees and saplings, gravel, sand, and stone. Any such wood, from about 4 to 14 inches in diameter, and from 10 to 20 feet long, can be utilized. It should be cut with the axe, and the whole of the small branches and twigs should be left on. The extent to which the jetty should project must, of course, be regulated by the size of the breach made. Commence by laying, when the water is at its lowest level, at the point immediately below the breach, a layer of the boughs with their thick ends facing the stream, and at an angle of 45°, or thereabouts; then barrow a layer of gravel, sand, or stone upon these boughs, leaving a yard of the thick ends uncovered; and continue this system to the required height, making the weir slope from the foot upwards to its junction with the bank. It will be found that at the first flood the projecting ends of these branches have gathered a quantity of silt and *débris* of all sorts, and that the whole mass of your materials have become immovably fastened together. If the breach is very large it is advisable to extend the weir by degrees, and not attempt the whole at once. I have recovered half an acre in one place by this process, and in no instance have I known a jetty constructed of these unusually cheap and ready materials washed away.

Being an old angler, I have made acquaintance with most of the rapid streams in Great Britain and part of Ireland; and with all the appliances at hand to make these effective, cheaply constructed jetties I have been surprised to find so little done on this principle of arresting and utilizing the scour of the stream, instead of merely attempting to divert the current. In almost all such cases as I refer to the great bulk of the material can be carted or barrowed at low water from the bed of the river; and in most cases trees can be lopped (if no fall is going on) of such branches as are required, without material harm being done to them. An immense amount of damage is done by not keeping clear the natural bed of the stream. If water is displaced therefrom it must of course impinge with greater force upon the banks; yet what is more common than to see an old root or a broken bough suffered to remain in mid-stream, gathering silt, and, in the very way I have described, forming an impediment capable of resisting the fiercest floods?

The Cedar.

The Cedar, with its beautiful spreading boughs and dark green foliage, is really a grand tree, and was the noblest of all the trees in Palestine. It is often used in Scripture as a type of magnificence and power: "The righteous shall grow like a cedar in Lebanon." The timber was used by David in building the king's house. Solomon esteemed cedar as the most valuable product of the vegetable kingdom, and hyssop the least. "Hew me," says Solomon in a letter to Hiram, "cedars out of Lebanon; . . for thou knowest that there is not among us any that can hew timber like unto the Sidonians." In those days the Israelites were agriculturists, and the Tyrians were skilled in cutting timber and in architecture. The goddess of Ephesus was a statue made of cedar-wood. But of the famous forest of Lebanon we are told by Belloni, who visited it in 1515, that only 28 trees remained, and Rawloff in 1575 saw only 24. Daudini in 1600 saw 23. Maundrill in 1696 saw only 15 standing and one blown down. Peacocke in 1738 saw 16. Burckhardt in 1810 saw 11, and Richardson in 1818 found only 7 trees. Maundrill gives some dimensions of those he saw, one was 12 yards in girth and 37 yards in spread of the boughs. Cortes, the conqueror of Mexico, according to Herrera, built a palace in which were 7,000 beams of cedarwood, mostly 120 feet long by 12 feet circumference. The wood emits an oil which destroys moths, and its sawdust has strong antiseptic properties. In some of the Eastern countries *Cedrus deodar* is still worshipped; hence, as some suppose, the name "God I ador." Cedar was introduced to this country about 1683.—*Jotting from Lom Fitt's Scrap-book.*

Salix—Willows and Osiers.

Of this family there are enumerated about 150 distinct species, many of which again are divided into numerous varieties. Almost the whole of the tribe are light, elegant, and rapid-growing trees, delighting in wet or moist situations, and therefore peculiarly adapted to the banks of rivers, ponds, and such like places.

A considerable change is made in the appearance of the willow by the difference of soil and climate, so that it is sometimes very difficult to ascertain the particular species.

Those kinds which attain to the size of timber trees are valued on account of their ornamental appearance and rapid growth, although their wood may be comparatively worthless.

The bark of some of the willows is used for tanning, and is considered by some to be as valuable for that purpose as that of the oak.

The basket-making willows, or *osiers*, are natives of most parts of Europe, and grow in moist, marshy, or fenny districts. They grow very rapidly, and if left uncut will become moderate sized trees. On the banks of large rivers osier beds may be planted with great advantage; and besides the profit, they are of great use in giving consistency and strength to river embankments.

Their uses in basket-making are well known. Willow is considered one of the best kinds of wood for making charcoal, and it is said that the best gunpowder is that which is made from the charcoal of the willow.

The timber of the willow tree is applicable to many purposes where lightness and toughness are desirable. Many of the species are exceedingly tough and flexible, a most valuable property of timber used in several branches of the arts and manufactures.

The willow is also a most valuable medicinal plant. It has been truly said, that if we paid better attention to our native herbs, it would be much better for us in a hygienic point of view.

It has been pretty clearly proved that the bark of some of the willows is equal to the famous Jesuit's bark in the cure of fevers, scorbutic humours, gangrene, &c., and the bark of *Salix alba*, the white or Huntingdon willow; *S. incana*, the hoary willow; *S. vitellina*, the yellow willow; *S. fragilis*, the crack willow; *S. pentandria*, the bay-leaved willow; *S. amygdalina*, the almond-leaved willow; *S. Russelliana*, the Bedford willow; and *S. caprea*, the goat willow,

has been used successfully as a substitute for quassia and cinchona bark. The bark of *S. pentandria* is also highly perfumed, and the same species furnishes an excellent down, which when mixed with one-third cotton is used like feathers for stuffing beds, cushions, &c., and its timber is less subject to rot than that of most other kinds.

Salix viminalis, the common osier, is a tree which attains large growth when left uncut, though the shoots grow amazingly long and strong in one year from the stools. The leaves are spear-shaped, long, narrow, acute, almost entire, of a bluish green on their upper side, and hairy underneath, and grow on very short footstalks. This is the most propagated of all the sorts for basket-making. It produces several qualities of different value, but all are nevertheless useful to the basket-maker. The varieties usually go by the names of the green osier, the old basket osier, Welsh wicker, &c.

Notwithstanding that the osier is usually planted by water, it likes a sound and dry soil. The places in which it most delights are drained moors and the banks of large rivers, both of which are peculiarly dry situations.

It has no dislike, however, to being occasionally flooded, and seems to be invigorated by such irrigation; therefore the sand-banks which we see frequently thrown up by the sides of rivers, and which sometimes lie waste for half a century before they become profitable, are very eligible spots to be converted into osier-grounds.

In planting an osier-ground or bed, the soil should be perfectly dry, and its surface thoroughly clean. Cuttings of the second or third year's growth, about 12 inches long, should be used, and planted in rows 2½ feet apart each way, in the month of March The cuttings ought to be inserted 7 or 8 inches deep, leaving 4 or 5 inches of wood above ground. The space between the drills should be kept well stirred, or the first year a crop of potatoes or mangels may be taken. The rows in either case must be kept perfectly clean with the hoe, and at the approach of winter the spaces between the drills should be dug, and the mould thrown to the roots of the young plants, in order to lay them dry and warm during winter.

In spring it will be well to trim off the first year's shoots (though not necessary), and replace the plants which have failed with fresh cuttings.

The second year the spaces between the rows must be kept well stirred, the hoe used freely, and the plants earthed up as before against the approach of winter.

The ensuing spring the stools must again be cleaned, although as yet the shoots will be of little value. At the third cutting they will be of marketable size, and will annually increase in quantity and value,

until the profits arising from them will appear to the uninitiated almost incredible. In situations which the osier affects, and in countries where the twigs are in demand, osier-grounds have been known to pay an annual rent of £10 an acre: under ordinary circumstances they will, if properly managed, pay £4 to £5 per acre.

In some counties osiers are sold at so much per bundle, in others the osier-grounds are let to the basket-makers on lease, who keep up the fences, and take upon themselves the entire management during the term of lease.

All willows may be propagated by cuttings, which may be done at any season of the year, although the best periods are autumn and early spring, just before they begin to shoot. The cuttings should be at least one year old, but better if two, and from 12 to 15 inches in length, in proportion to their thickness, and ought always to be planted in an upright position, not slanting.

D. D

Preserving Wood Posts for Fences.

WHERE anything like a fair price can be realized for rough timber instead of sawing it into paling rails for home use, there can be n doubt that it is better management to sell the wood, as a more effective and cheaper fence can be erected with wire.

Wooden palings are things of the past, they are behind the age, and for permanent fences it is only in special places and on a very limited scale that paling is preferable to wire. The same cannot be said with regard to posts. Wood makes a very good intermediate post, and in general fencing is likely to hold its own for that purpose as against iron.

The liability of stobs to decay at the surface of the ground is no doubt a serious objection, and if this could be entirely remedied, a decided advance in fencing would be effected. This is the vulnerable point in a wooden post, and we fear even with the very best method of preserving, that it will always, more or less, be subject to premature decay at this particular place. Although stobs decay first here, and have to be rejected, if the top post is at all sound they need not be discarded altogether, there are still a variety of estate purposes for which they can be used—such as repairing old hedges that have got somewhat open below, piles for protecting river embankments from the encroachment of floods, for strengthening another fence, where economy is the first object, by driving down to the second or third wires, and on moorland where a cheap fence is wanted to define a sheep-walk. The Marquis of Tweeddale's factor introduced on the estate of Yester a method of preserving posts which I think worthy of notice in your *Journal of Forestry.*

The wood was peeled, and the stobs stacked for two or three months to dry; they were afterwards placed in a large square iron tank and boiled in coal tar for twenty-four hours, by which time the tar, if the post be of white wood, will have penetrated pretty well into the fibre.

Where the wood is young and soft-grown, I consider this a very good mode of preventing rot. The very high temperature in which the wood is placed, and that for such a length of time, not only expels any natural sap that may have been retained, but, to a large extent, it also impregnates the cells with the tar. This is where the chief

defect lies in the principle of charring posts, even when carefully done; wood being a bad conductor of heat, the charred posts are not only weakened by the process at the very place where strength is most required, they are also often very imperfectly dried. As an example of the good effect of *boiling* stobs in coal tar, on the estate just mentioned I assisted sixteen years ago to prepare some young Scotch fir stobs which were treated in this way; the wood from which they were made was thirty years of age, and the wire fence in which the stobs were used is still standing.

Had they not been boiled they would not have stood longer than six years. When the posts are of redwood larch this process has little effect, as the tar does not enter easily into the fibre of the wood—that is, it does no more good than if laid on with a brush.

The method of preserving which I practise myself—I use nothing but larch, chiefly redwood—is to have the posts stacked outside for twelve months at least in an open airy place. The alternate wet and dry when standing outside appear to season them more thoroughly, and they do not suffer otherwise from it. Two months previous to tarring have them removed under a covered shed where there is a free circulation of air. The tar is simply laid on with a brush for some distance both above and below the ground level of the post. It is best to apply the first coat hot, but other two coats may be given cold, always allowing the former one to dry first. I may mention in passing, that if it is intended to paint the fence, the bottom of the posts should be painted also, as paint does not retain its colour when applied above tar. A paint which we have used extensively for outside work, and which answers this purpose admirably, is Messrs. W. Carson and Son's anti-corrosion preparation. With the bark on, some kinds of wood do not appear to season at all outside, and when it is intended for stobs it should be put under cover immediately after felling.

This treatment is very advantageous to Scotch fir posts. In conclusion, I think it bad economy, with the present high rate of labour, and when no preserving is resorted to, to use any other kind of wood for fence-posts than good larch, with as much redwood in it as can be got. W. W R.

The Aphis or Plant Louse.

By D. SYM SCOTT, Forester, Ballinacourte, Tipperary.

This may be termed the real plant louse. Almost every plant supports a different variety of this insect. The Aphis forms a numerous family, and groups with the "Larch Bug" in the sub-order *Homoptera*, order IV., *Rhynchota Insecta*. The insect is more or less flask-shaped, with a pair of antennæ, six long slender legs, two tubes protruding posteriorly, and is winged and wingless.

The true history of the Aphides is as yet greatly enveloped in obscurity; still we are always finding out something new regarding them. The most astonishing feature in the insect is its extraordinary multiplying proclivities. Each generation is estimated to number on an average one hundred, and there are in most instances ten generations in the year. They are asexual, multiplying by a generation of fruitful virgins.

The process of incubation is carried on in an abdominal cavity, such as many of the minuter insects are endowed with, and which admits of internal germination, being a process similar to the reproductive system by external buds. Steenstrupt advanced a theory that Aphides were produced on the principle of "alternation in generation," or each brood differing from the last, until a change of circumstances, such as the alternating generation being exhausted, when the original perfect insect was produced. Several other theories were started regarding the Aphis, but for want of sufficient data to work on have never been well founded.

It was long supposed that ants were their natural enemies. This, however, is not the case, as they seem to live on the most friendly terms. From the posterior tubes of the Aphis a sort of sweet fluid is exuded, which is highly relished by the ants; so much so is this the case that the Aphis is called the "ant's milk cow." Birds have no particular desire to pick them; at all events, I have never observed them frequenting spots infested with the insect. My own opinion is, we must look for some small insectivorous animal or insect as their enemy. In a field here every thistle is actually black with Aphis, and paying particular attention to their development, I find an infinite number of skeletons adhering to the thistle, which in a measure supports my opinion that their enemy is much smaller than themselves. Perhaps some of your readers will favour us with their experience and views on insects infesting forest trees.

A Tour through the Woods and Forests of Duff House, Banffshire.

Out for a holiday! a grand, bracing, health-invigorating holiday, to be spent in examining the Duff House grounds and plantations, the seat of the Earl of Fife. We shall not enter into any traditional account or legendary lore in connection therewith, but shall confine ourselves strictly to its arboricultural features. All who have visited the district must know that the grounds are in proximity to the town of Banff, and intersected by the River Doveron, or in Gaelic "the black water."

After crossing the Bridge of Banff, which is of seven arches, and spans the Doveron, we immediately approach one of the main entrances to the grounds, a large massive iron gate. The few trees that enliven the neighbourhood of the entrance, inside the gate, are composed principally of hardwoods, viz., plane, elm, and ash. Here one is struck with their stunted-like appearance, and also the effect of the prevailing wind, which is very great indeed, the trees being all more or less stag-headed, and growing to one side, caused no doubt by the fierce storms which frequent these northern coasts. Among these trees, and surrounded by a neat fence, are planted a number of black Austrian pine (*Pinus Austriaca*), and thriving very well since they have been planted.

Travelling along the carriage drive, we meet with many more trees, all telling the same tale, viz., the severity of the Boreal blast. The trees which seem to resist the blast best here seem to be the poplar, beech, and plane. On the right hand stand the gardens, in which is a handsome evergreen oak (*Quercus ilex*). We are informed that this is one of the largest on the estate, but although not possessed of a long bole or stem, yet its beautiful well-developed umbrageous head induced us to stop and take its dimensions, which are as follow:—circumference of trunk at 1 ft. from the ground 5 ft. 4 in., circumference of branches 102 ft., height 25 ft. Altogether it is a handsome tree, and well worth the space it occupies. We next join the other main drive, having another massive iron entrance gate, and opening into the main street of the town of Banff. Inside this gate are many different kinds of trees and shrubs, consisting of evergreen oaks and purple beeches on one side, and on the other are a few acacias, with their beautiful but small leaves giving beauty to the outline, especially

when contrasted with their neighbours, the stately walnut (*Juglans regia*). Conspicuous among others stands a noble English elm (*Ulmus campestris*), the dimensions of which are—circumference of bole at 1 ft. from the ground 11 ft.; the same taken at 5 ft. measures 9 ft. 6 in.; length of trunk 10 ft.; diameter of branches 83 ft. This is a magnificent tree, with its herculean limbs and noble head towering to the height of nearly 60 ft. We regretted to see that a beautiful limb had been broken off during a gale of wind; and another, from its appearance and wide-spread dimensions, is likely soon to follow; however, we were informed that a chain is to be put round the limb and fastened to the trunk to prevent its splitting. We next observe two beautiful specimens of the white poplar (*Populus alba*); the circumference of one at 5 ft. from the ground is 7 ft. 9 in., with a fine clean trunk about 35 ft. before it branches. Number two is 8 ft. 4 in. girth at 5 ft. up, with a trunk 25 ft. long: both heads are in proportion, beautifully developed and wide-spread.

The majority of the trees in the Policy grounds are not such grand ornamental specimens as we have seen, but when soil and exposure are taken into account, together with their early management, we may consider them fair examples. Here and there are planted numerous young hardwoods, which in time will take the place of their older brethren, and by being well protected from the inroads of sheep, seem to be thriving beautifully. Near by is a young plantation of modern date, having been recently taken off the grass parks with the object of still further sheltering the house, and adding to the present extensive policies. We need not here enumerate the countless walks with their graceful sweeps or curves; sufficient to say that they all arrive at one termination, viz., Duff House.

This splendid mansion was built in the years 1740—1745, after a design by the elder Adams, at an expense of £70,000, the style being purely Roman. The whole edifice is indeed rich to excess in architectural decoration, and can only be seen to advantage by being viewed close at hand. We had the pleasure of seeing the rich collection of pictures, but space forbids us entering into details.

Retracing our steps we observe a fine specimen of the yellow-flowered horse-chestnut (*Pavia flava*), beautiful indeed. We next come upon a handsome ornamental plane, or sycamore; the circumference of bole at 1 ft. from the ground is 8 ft. 6 in., and at 5 ft. up is 7 ft. 6 in., length of the trunk 12 ft. It then forms into a beautiful head, nicely balanced for nearly a height of 45 ft., with lovely spreading branches, the diameter of which is 53 ft. Among recently planted young trees are two specimens of the *Abies Douglasii* (Douglas spruce), also a handsome plant of *Picea Nordmanniana*, all protected with wire netting, and in a fine thriving state. We next

come in contact with a beech (*Fagus sylvatica*), said to be one of the finest on the estate, the circumference of the trunk at 1 ft. from the ground being 13 ft., at 5 ft. from the ground 11 ft., length of clean straight trunk 20 ft., diameter of branches 55 ft., the total height being 75 ft. Continuing this walk we observe several very beautiful trees and numberless shrubs, conspicuous among which stands a larch (*Larix Europæa*), the circumference of which at 5 ft. from the ground is 8 ft. 9 in., length of clean bole 25 ft.; it then commences to throw off numerous branches, until it reaches a height of 65 ft. Altogether it is a very handsome specimen.

A little further on, and we are face to face with two grand specimens of the common oak (*Quercus pedunculata*). These oaks, our informant told us, were planted in 1740, as previous to that time little or no timber adorned the present spacious park; but these grand "Monarchs of the Forest" are indeed worthy of more than a passing notice did space permit. The circumference of the one at 5 ft. from the ground is 8 ft., with a length of stem of nearly 80 ft., and the spread of its branches is 53 ft. The other oak, its nearest neighbour, at 5 ft. from the ground measures 7 ft. 9 in. in circumference, height almost the same, viz., 80 ft., with a spread of branches of about 47 ft. These two oaks reflect credit on the hand of the planter, and would also afford scope for the painter or the poet, as "The Monarch Oak, the Patriarch of Trees."

We are now again by the side of the winding river, rolling along with irresistible sweep, irrespective of the surrounding beauties. By this river side are some splendid specimens of the silver fir (*Picea pectinata*), over 100 ft. high, and containing over 200 ft. of timber; but as time prevented us taking their dimensions we bade our guide good-bye, resolving to meet again for further inspection.

D. S. J.

(*To be continued.*)

The Planting of Stanage Park.

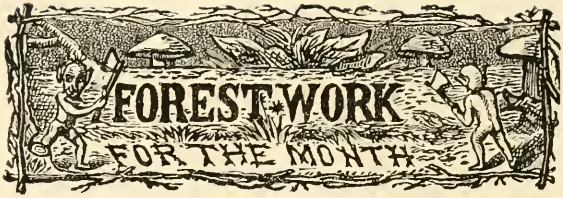
The experience of those who have actually planted and reared trees cannot fail to be useful, and the following account given by Mr. Edward Rogers, of Stanage Park, in the county of Radnor, will no doubt be found interesting. It is dated in 1835, but facts do not deteriorate with age, and what was true then is equally true now. He says:—In the year 1799 this park was so entirely denuded of timber, that in the space of 417 acres I can recollect only 43 oak trees of large dimensions; birch, ash, and alder constituted the remainder of the wood. My father immediately commenced by enclosing about 150 acres, which he dibbled with acorns, and gradually planted with trees of various sorts. He proceeded to make other enclosures containing 39 acres, which he planted in the same way, and shortly after he commenced planting a hill that overhangs and adjoins the park to the extent of 168 acres more. The greater part of these plantations were dug with holes, and the trees planted by hand, at the distance of four to five feet apart, taking care to insert oak in such places, and at such distances, that they might stand for timber. In only one place have the plants been nicked into the turf, and that was on the highest part of the hill, where small seedling plants were used, in the hope, which has been fully justified, that they would become better rooted and firmer to resist the wind when their height should expose them to its power. In all these plantations, both in and out of the park, the growth of the oak timber has been most satisfactory, and I may safely challenge any planter to show as large a number of thriving oak plants upon an acre as may be seen here, wherever the larch and Scotch fir have been cleared away. This clearing, which is constantly going on, would proceed more rapidly were it not for the difficulty of disposing of the fir poles. In some of the later plantations I have endeavoured to obviate the evil of the mixture of the firs with the oak, for there is always a difficulty in removing these nurses in proper time. I have planted alternate rows of larch, Scotch fir, and oak—in some instances two rows of Scotch fir to one of oak, and I remove an entire row of the fir timber at once, and so continue till at last I get rid of it altogether. The firs are in this way more easily got at and removed, and with less danger to their neighbours, than when planted on the usual mixed plan. If there should appear any objection to the

trees remaining in rows, it may be obviated by removing some of the young oaks, and by planting occasionally one or two oaks in the rows of the firs. In the earlier period of these plantations the larches were much affected by the white insect, but they seem in their growth to have entirely thrown it off, and nothing can be more straight or beautiful than the appearance of the plants at present. I may remark that much mischief has been done in some places by the field mouse, which has been known to bite asunder oak and beech plants of an inch and a half diameter, nor have we been able to devise any effectual means of destroying these animals. The firs they never touch. The trees which have thriven least have been the beech and lime, and I am inclined to think that our soil, which is very deep clay, is not at all congenial to these species. The beech grows and swells for a certain time, and then the bark cankers and the leaves fail. The lime (the red-twigged), which has been planted in various places for ornament, bursts its bark, and becomes diseased at the point where it issues from the ground as soon as the trees acquire any size. All the tribe of firs, except the Balm of Gilead, prosper greatly, but the oak is the tree that thrives the best, and I have many trees that have not been planted more than twenty-five years which measure two feet nine inches in circumference at five feet from the ground, with bright and shining bark and clean heads. The soil, indeed, seems most congenial to the growth of oak timber, for the few old trees that remain are of great size, and the stumps of very large trees are yet visible in many parts of the park. Most of the trees now growing in these woods were purchased as seedlings, or grown from acorns and planted in a nursery, from which they have been transplanted after two or three years. Many thousands of trees of various sorts have been planted out singly for ornament; of these the Turkey oak and Spanish chestnut thrive the best; the Spanish chestnut swells and increases rapidly both in bulk and height. The sycamore also thrives greatly and luxuriantly. In planting single trees I have followed the Dutch method of giving them precisely the same situation with regard to the points of the compass as that in which they stood before they were moved; and I find that the roots shoot, and the trees recover themselves much sooner in this way than when transplanted without consideration, and I have found much advantage in a plan recommended, I believe, by Mr. Loudon, for keeping the trees steady and firm in their places by placing three pieces of wood triangularly on the root, and pegging them down to the ground by long forked stakes at the angles. I have not much adopted Sir Henry Stewart's plans, for I found they required considerable expense, and more constant attention than my labourers would give.

As a specimen of the cost of planting in 1827, the following statement is made respecting 35 acres, consisting of two pieces of ground :—

1st piece—Scotch fir		11,600	
Spruce		6,550	
Beech		9,300	
Oak		10,100	
			37,550
2nd piece—Larch		10,000	
Scotch fir		9,200	
Spruce		2,000	
Oak		4,800	
Beech		2,000	
Spanish chestnut		600	
Silver fir		400	
			29,000
Total number of plants			66,550

The cost of which was—	£	s.	d.
108½ perches of hedging at 10d.	4	10	5
55 „ of draining at 4d.	0	18	4
Making 29,000 holes at 10s.	14	10	0
„ 19,400 „ at 9s. 2d.	8	17	10
Cutting stakes and loading	0	18	0
Carriage of trees, seven days at 18s.	6	6	0
Labour	17	18	0
Value of trees at 30s. per 1,000	99	15	0
	£153	13	7



ENGLAND.

Planting should occupy most of the forester's time during the open weather of November. Place all smaller plants in position early in the month, and remove larger ones as fast as the leaves fall. If dry weather continues long after their removal, consolidate the soil round them by treading or otherwise. In some cases it may even be necessary to resort to watering; but these are rare. In exposed situations stake and tie larger trees, taking care that the bark is not injured either by stake or string.

Where drainage is necessary as a preparation for spring sowing in the nursery, or planting in the woodlands, lose no time in getting it in hand; and do not hesitate to go down from three to four feet—the nearer the latter depth the better. By the early removal of water the frosts of winter will more completely pulverize the soil, and prepare it to receive the benefits of the first warm showers in spring.

When sales of coppicing come off early in the month much of the underwood may be cut down in November, and the stools may be dressed smoothly and evenly, so as to throw off water. The operation of felling from stools should never be continued during the prevalence of sharp frosts, as the result will be the loosening of the bark from the wood, and the checking of adventitious buds in the following spring. Cut low inall except very wet situations. The most numerous, straightest, and best poles are produced by low cut stools. Cut off all brush and small growths with the billhook, and use the cross-cut saw wherever the poles are 5 or 6 inches in diameter, finishing up with the adze. Before applying the saw cut through the bark all round the pole with the handbill; and to prevent any tearing of the bark from the wood apply the saw a little above the cut so made. Direct all blows upwards, and use good cutting tools. Heavy and very blunt tools shake the roots and sever the smaller fibres. In making the first cutting from young plants great care is necessary, as their productiveness will depend much upon the manner in which this is done. Where the stools are allowed to rise several inches, or even feet, as they

sometimes do, above the level of the ground, the shoots obtain but little nourishment from the roots, and are liable to injury from high winds and falls of snow.

Where clearance roads are "brushed," or covered with fagots, these should be laid down before the ground is cut up, and as soon as they can be obtained from the fall. When well laid and kept in their places by a few sods, or a little ballast, or burnt soil strewed along the centre of the track, they will make a good road throughout the winter, and carry heavy loads. In most cases where the roads are good purchasers will effect an early clearance. Erect barriers to limit purchasers to the use of the appointed roads, and enforce a strict observance of the conditions of sale. Very few "particulars" contain a clause binding such purchasers to the performance of their work in a manner satisfactory to the forester or woodreeve.

The seeds of the Scotch pine, silver fir, Norway and spruce firs, holly, and the oak may now be collected; and such as are not sown at once should be stowed away where they will have the benefit of a dry and airy situation. Collect seeds of plane for sowing in February and March.

Towards the end of the month fell birch, beech, sweet chestnut, and alder, and strip off the bark as soon as fallen. To insure ash from becoming worm-eaten, and also to preserve it from rot, it should be felled between the middle of November and the end of January.

November is a good time for grubbing or removing old hedges, planting new ones, and cutting off, layering, or plashing such as have through neglect become bare and hollow at the bottom. In layering take care that the spurs are cut off smooth and even, and close to the layered part. This will insure a more plentiful supply of new shoots from below the partial severance. Secure all tree guards, and carefully examine newly washed trees. By grubbing old plantations early we obtain the advantages of clearance in fine weather, time for drainage, and the benefits of frosts upon the soil.

The making and repairs of roads may be continued, and particular attention should now be paid to their drainage, and to the soundness of culverts or pinnocks before the winter floods come. Collect leaves for use in the nursery, and secure cuttings of all trees intended to be so propagated. Remove ash and beech from all woods intended to be cultivated as coppice: nothing will live under them. Where hedgerow timber has not already been pruned it should now be trimmed up without delay, and the trimmings removed before the adjoining lands are sown. Now is the time to clear rushes and the willow herb *Epilobium hirsutum* from the margins of streams, and otherwise to scour their channels.

Pluckley, Kent. A. J. Burrows.

SCOTLAND.

From all quarters we learn that great damage has been caused by the severe storm of wind experienced in the middle of last month, so that in all probability the usual routine of work will have to be suspended until the fallen trees are dissected and the *débris* cleared away.

It saves a great amount of time and labour to keep a cart following the men during these operations, in order to carry off the brushwood when it cannot be burned on the spot, and also to remove the timber to wherever its destination may be. If this work is not done when the men are on the spot, the ground has all to be gone over again, causing a needless waste of time.

Examine carefully all transplanted trees, especially those liable to be tossed about with the wind; the heavy rains will tighten the rope fastenings of those that are staked, and require adjusting so as not to chafe the bark.

Push forward all operations that may have been delayed last month from the stormy and wet weather, and complete all autumn work at as early a period as possible, so as to allow all hands to be turned on to the planting as soon as the nature of the weather and the state of the young trees permit. Look up the stock of planting tools to see that all are in perfect order. When planting is begun, carry it on with the utmost vigour while the weather is mild, so that all suitable or moderately dry ground may be planted before severe frost sets in. The great advantages of autumn planting are apt to be too much overlooked, and work that could be most successfully performed just now is put off till the spring, which may turn out to be hot, dry, or windy, which tells most severely upon newly planted trees, and often kills outright a large percentage of the spring planted ones.

See that all drains and watercourses are kept clear of the *débris* swept into them by storms and floods.

Trench or double dig and ridge up all ground in the nursery as soon as it is cleared of the young stock, so that the frost may mellow and sweeten the soil so ridged up during the winter. Collect leaves for compost when the weather is frosty.

Plant thorn and all other kinds of deciduous hedges; and see that all vermin-proof fences are in thorough repair around young plantations.

Dalkeith Park. ROBERT BAXTER.

IRELAND.

General cutting and clearing of wood should now be carried on. Oak trees intended for peeling may be left until the season comes for taking off the bark. Hedgerow trees ought to be cut during this

month, so as not to interfere with agricultural operations. Scollops (provincial for small rods) should be cut judiciously to perpetuate the crop without injuring the undercover. Hardwood plantations intended to be converted into larch and fir should be felled, and the ground cleared for immediate planting. Planting operations ought to be advanced as much as possible during the present fine weather. In this country, where vegetation is early, larch and all deciduous trees should be planted, if possible, before Christmas. When planting near ground infested with rabbits we would strongly recommend the spray of ash or holly to be left on the ground, among or near the plants. As the rabbits are very fond of ash bark they will scarcely touch a tree as long as there remains any of it to nibble at. There being a great many line fences with us requiring plashing, now is the time to look over them and have all gaps refilled. Plashing should never be attempted until the bark adheres firmly to the wood. Look over all the fences and repair where required.

There is no reason why foresters should not cultivate their own plants more extensively. Every estate having any pretension to forest work should possess a well-stocked home nursery. During this month gather haws, ash and sycamore keys, acorns, and chestnuts. Place the haws in a rot heap, to lie a year; the ash and sycamore may also be mixed with loam to rot until February next, when they and acorns, beech, and chestnuts, may then be sown. Continue planting in the nursery, cutting off laurel, poplar, willow, privet, and other sorts cultivated in this manner. Remove seedlings into rows, being careful to give them room enough to admit of weeding and hoeing. Plough, dig, and thoroughly clean the ground before planting.

On the farm much can now be done at trenching, draining, and fencing.

Ballinacourte, Tipperary. D. Sym Scott.

WALES.

The present month will be a busy one with most foresters, as planting, fencing, and, where possible, the thinning of plantations will have to be proceeded with. We consider this one of the best months of the year for forest tree planting, which ought to be pushed forward during favourable weather with great energy. When the weather is unsuitable for planting, the workmen may be employed fencing, draining, clearing, and preparing ground for the reception of the young trees. The ground should be well fenced before planting operations are commenced, and where ground game abounds wire netting will be necessary as protection. The kind we have in use is 3 feet wide, 1½

inch mesh, of No. 16 wire, galvanized before being made, and laced to a No. 9 galvanized wire at top and bottom, and stapled to wire fence-post (irrespective of the wire constituting the fence), so as to be removed at any time without interfering with the fence. If the fence is other than wire we attach the netting to small stakes put into the ground at 9 feet apart.

Trench, and prepare beds for planting young hedges, and continue cutting existing ones, as last month.

The general thinning of plantations should be proceeded with where convenient, but many foresters may be deterred in this department of their work through the preservation of game. Where such is the case, it is advisable to have all other work posted as well forward as possible until the woods have been shot through. Great care should be taken in thinning young plantations to give plenty of room to thriving hardwood trees, or others intended for the main crop, even should the taking out of nurses of larger size reduce the present appearance of the plantation. Where the trees have been neglected for want of thinning, it will be necessary to have the best and healthiest trees, irrespective of sorts, that are likely to attain maturity—such as are well furnished with branches and healthy foliage, in preference to overdrawn branchless poles.

Roll walks and grass in pleasure-grounds, and sweep and clear decayed and fallen leaves.

We had a severe storm of wind here on the night of the 14th and morning of the 15th October, but escaped with comparatively little damage—only very few trees blown down, with several branches of large trees broken off.

Kinmel Park. LEWIS BAYNE.

[*Correspondents sending letters signed with initials or fictitious names are requested to enclose their name and address, as otherwise their communications cannot be inserted.*]

PRESERVING WOOD POSTS.

SIR,—I am glad to see that the correspondence on the above subject is continued in a friendly and profitable manner. We must all thank Mr. Baxter for his further explanations of his system of renovating old fences. His turf and soil must be a great deal firmer than the most of Roxburghshire, as we find paling fences require frequent stays, or "rances" to keep them in their proper position for any length of time, especially where cattle have a tendency to rub or reach over in trying to get at corn or any herbage on the other side of the fence.

While alluding to Mr. Baxter's letter I cannot pass over his remark, "We can't afford larch here." It is my opinion that there is no cheaper wood for fence posts than larch, and rails should also be of larch where the fence is required to stand permanently. Last spring we replaced a larch paling, the bars of which had lasted forty-eight years; many of them were fresh, and used for repairing in hedges. Stobs had been added year by year, till parts of the fence looked like an upright one. These bars had been sawn from trees from three to five inches diameter.

I have not yet been able to determine what is the best way of preparing wood for posts. We have men of great experience telling us that felling in winter, charring, tarring, creosoting, and drying, is the *only* way to preserve timber. In a wire fence here part of the posts were peeled in summer, sawn, dried in the open air, and charred; others were peeled in winter, sawn, and placed in the fence alternately, and the whole painted with coal tar above the ground level. The fence is at one end on a clay, and at the other a gravelly soil. I find some of each decayed, and some quite strong.

I should like to know the size of Mr. Baxter's iron prongs; the saving in the price of material is a very small one, and as a useful experiment I would recommend him to try a larch stob against an oak one prepared in the same way, keeping in mind that the oak used shall be of the same value per cubic foot as the larch. M. R.

SIR,—I have read with much interest the various suggestions for the preservation of wood posts from rot. At page 428 "A. B." says, in speaking of the steeping of posts in corrosive sublimate, "That this is intended as a preservative against rot many doubt." I think "A. B." means that many doubt its capability of preventing rot in wood. I assisted to erect a fence of six wires in the west of Stirlingshire in 1857. The posts were sawn from larch sixty years old, cut into posts or stobs 4 in. by 3 in., and were all well seasoned before being used. In 1868 more than half of them were rotted over by the surface of the ground. The soil is a compact sandy loam. At the same time a fence of four wires was erected on a neighbouring estate on the top of an old turf dyke. The posts were split (not sawn) from larch not above five inches in diameter, and in many instances less, and then kyanized. In 1869 I examined a number of them by removing the earth from around them and taking a chip off them at and below the surface of the ground. I found them to be quite sound and hard, and not the least appearance of any decay.

Upon an estate belonging to the same proprietor as the last, a fence had been erected with kyanized and *not* kyanized posts placed alternately. In 1869 the posts that had not been kyanized had been replaced twice. I cannot say when the fence was first erected. The clerk of works on the estate had been twenty-two years there in 1869, and it was erected before his time; but he stated that the kyanized posts were still good.

There can be little doubt that the process of kyanizing is a preventive against rot in wood. As to the cost I cannot speak, but I may be able to do so soon.

ANDREW SLATER,

Rose Cottage, Loftus-in-Cleveland, 5th October, 1877. *Forester.*

SIR,—Your correspondents Mr. Baxter and "A. B.," in your last issue, expressed a desire to know the results of my experience in the casing of posts with lead or zinc. I regret to inform them that I have not seen the plan practically carried out, but I certainly will give it a trial should a favourable opportunity present itself, and I believe it will prove more efficacious than any of the methods yet recommended in the Journal.

"A. B." seems to think that the nails I proposed for fixing the casing would be likely to give way. In my opinion those above the surface would last as long as any other, and if they gave way underground, the adhesiveness of the white-lead and the surrounding soil would keep the casing intact. He is also dubious as to the durability of white-lead underground, but when it is separated from the soil by the casing it will retain all its qualities and remain durable for any length of time. However, when in a soft state, if it and the soil came into direct contact, the latter would extract the oil from the lead, and it would then become comparatively useless.

A. SLATER, JUN.

Wyeside Cottage, Lancaster, October 13th, 1877. *Overseer.*

SPRUCE TIMBER.

SIR,—Mr. Wilkie appears to be labouring under the impression that I have been taking a one-sided view in this discussion. Now as far as I understand the term "one-sided," it means that a person from a certain standpoint looks at one aspect of a subject only, and declines to believe the fact that others may have just reasons to view it in a very different light. Well, the position Mr. Wilkie occupies just now is this,—he asserts that soil and situation do not affect the lasting qualities of spruce timber so much as the proper seasoning and ventilation of it after it is cut; and further that the spruce throughout the whole of Scotland is of uniform good quality. So certain is he of this, that he says I have only to take a tour through the country to gather information on the subject, and I will come to the same conclusion as himself. This may be what he considers a very liberal view of the subject, but I fear it is also one-sided, because, as I have said before, I can put my hand on indisputable evidence that in no sense does it apply to the spruce grown here. Whatever the causes may be of this difference may be a matter for discussion, but the fact that it is so is beyond dispute, so that the only way of reconciling this conflicting experience is to admit that at least there is one locality in Scotland where inferior spruce is produced. My friend weakens rather than strengthens his position when he assumes that our timber is not cut at the proper time, nor yet well seasoned, because he has no right to assume anything of the kind, and for aught he knows to the contrary we may be doing the very thing he recommends. I hope, therefore, he will not insist on your readers accepting the incredible proposition, that the spruce timber here must be good because it happens to be so elsewhere.

The evidence which he has furnished us with about his redoubtable spruce fence has not been quite satisfactory, as in his original statement about it he led us to believe that it was made up entirely of spruce, and that it had stood for thirty years without needing repairs. It turns out, however, not to be a *wood* fence at all, as the term is usually understood, but a *wire* fence with a wooden rail on the top, three-fourths of which, notwithstanding the coating of tar, has had to be renewed as well as half the stobs. Were these latter spruce too? or larch? Such evidence is far from being conclusive.

If it is true that a "simple statement for or against the durability of spruce timber is not enough," then every word which our friend has written on this subject must fall to the ground as unworthy of notice, since as yet we have got nothing even from him but a "simple statement," and according to his own showing that "is not enough." He has, in short, committed the very foolish act of cutting off the branch upon which he was sitting! Further, he has not the slightest hesitation in believing in events that took place thirty years ago in reference to the minutest details connected with the shipping, storing, and charring of stobs for a paling, but when he is asked to believe another fact that rests precisely on the

same foundation, he tells us that the evidence is not enough, and the only reason we can discover for his incredulity is that it does not square with a favourite theory he has adopted.

If I had stated that the Sultan of Turkey had taken up his winter quarters in Argyleshire, or something else equally absurd, then there might have been room for doubt; but when I am recording the accumulated evidence of many years' experience, and still find he pronounces that "not to be enough," then I can only say I have no more to offer, and that I am sorry for his unbelief. Then as regards the latter part of the sentence, where he fancies that I am "interested in the disposal of that class of timber that he is seeking to lower in estimation, and consequently in value," I would in charity believe that our friend does not realize the full meaning of the words he thus uses; for surely it would be an infallible proof that a man had lost his senses were he to circulate throughout the country an unfavourable report about wood he wishes to sell, in the expectation that it would prove a tempting bait for the wood merchants. In this quarter at least we follow the old-established custom of saying as much in favour of our wood as we conscientiously can, and leave our customers to judge for themselves. Then there is another conclusion which we must come to, if Mr. Wilkie's letter is to have any meaning at all. It will be observed that the readers of this Journal are warned not to accept a simple statement coming from an individual like me, but they are expected to draw the very modest inference that they ought to have the most implicit confidence in the conclusions which my friend has so ably reasoned out, and I have no doubt they will appreciate to the full extent the advice given. I will express in a few words what I trust is felt by every one of your correspondents to be the only safe and honourable footing we can occupy in regard to such matters as this, namely, that a man's signature ought to be a sufficient guarantee of the truthfulness of all statements he may advance in relation to matters of fact; and if any one violates this rule, depend upon it, the recoil will be upon himself.

Secondly, every writer must be credited with being perfectly sincere in the mutual interchange of opinion in regard to questions on which we are not all agreed; for if we allow an element of suspicion to infect and pervert our minds in regard to the purity of each other's motives, then all reasoning is at an end. Such being my views, it is almost superfluous to state, in reply to the imputation already referred to, that the only motive which I have in writing to this Journal is a desire to help, however feebly, in some way every one of its numerous readers.

Dalkeith Park. ROBERT BAXTER.

P.S.—Since Mr. Wilkie has expressed his thorough confidence in the plan of inserting the thin strip of hardwood between the rail and the stob, I have no doubt he will try the experiment on the next fence he erects, and hope he will let us know how it succeeds. R. B.

THE PINE BEETLE IN HAMPSHIRE.

SIR,—I send you a few beetles, a piece of bark, and a small shoot of a Scotch fir tree ; you will see the shoot is this and last summer's growth. I cannot find any beetles except in the young shoots on the tree, or in those blown off by the wind, and in the cordwood, which was cut last winter and lying up till lately by the sides of the roads, where, after close observation, I am satisfied most of the beetles have been bred.

I shall briefly describe them as found, in the hope that some of your readers may be able to suggest a practicable means of getting rid of them. I believe it to be the same as described at page 245.

The plantation is situate about seven miles inland, and 120 ft. above sea level.

The portion attacked is all Scotch fir, thirteen to fifteen years planted, and thinned last winter for the second time ; the soil a poor black and white sand.

The trees are slow growing, but healthy. I have not seen the beetle in any quantity till this summer, and now they are mostly on the trees where thinned last winter, when all the branches were tied up into fagots and cleared out at once, the poles and rough cordwood being stacked along the sides of the roads. On the beetle first making its appearance I could not find it on the dry wood, but after moving a quantity of it I found the beetles in various stages of growth under the bark ; those in the top sticks had gone to the trees, whilst in the bottom of the stacks they were in all stages.

On many of the trees they have scarcely left a branch or top untouched. I have found as many as eight beetles in one small growth of ten inches long ; having eaten into the pith they travel along it for days—how long I do not know—eating it as they go. The branches are withering on the trees. I have shaken off a quantity of them, and gathered and burned them with a view to lessen the numbers of the voracious insects. What I should like to know is, how long will the present beetles live, and what will they leave behind them in the shape of eggs ? or will a quantity survive the winter to breed in the spring ?

Is the dry wood the only place where they will breed ? If so, we may to a great extent keep them under.

If you think this (or part of it) worthy of your Journal, you can use it, in hopes that some one better acquainted with the habits of the pest may give us some information about how to extirpate it.

A SCOTT.

Southwick Park, Fareham.

GROWTH OF LARCH.

SIR,—In looking over a plantation of young larch the other day I was much surprised at the growth of some of the trees. Our climate (the north-east coast of Yorkshire, near Whitby) is not as a rule considered a particularly favourable one, and therefore the matter arrested my attention.

The trees in question were planted on the site of an old wood of ash and oak in the year 1868. For a few years there was but little visible progress, but about four years ago the place was drained, and there has been since then a great alteration. The site, I may remark, is a sloping bank with a north aspect. The upper part is somewhat exposed, but the bottom is sheltered, and borders a little brook. It is by the side of this stream that the trees have made such notable progress. I had a few measured. That which seemed to be the tallest was about 25 ft. in height, with a circumference of 12 in. at 5 ft. from the ground. Another which stood near it seemed to be of equal height, but of somewhat smaller girth. The next tallest that was measured proved to be 24 ft. in height, and 11¾ in. in circumference. Several others around it appeared to be of precisely the same dimensions. All these trees were within two or three yards of the stream. From thence as you went upwards they gradually became smaller, until at the top the average size seemed to be 5 ft. to 6 ft. Many were considerably shorter than this, and none, I think, higher than 8 ft.

The soil is a clay, mixed with shale, belonging to the prevalent boulder-drift of the district.

As such a growth as that of the trees just mentioned is somewhat unusual in this part of the world (being 25 ft. in nine years), I thought the fact might be interesting to some of your readers.

J. W. Barry.

Heworth Hall, York, October 8, 1877.

LARGE YEW TREES.

Sir,—Your correspondent who gave us some "gossip about the yew" at page 218 of your last month's issue, in quoting from Sir John Sinclair's Statistical Account of Scotland, among others, mentions a yew in the parish of Kippen "covering by its lower branches a circle of 140 feet in circumference," but judging from its present dimensions a considerable period must have elapsed since that measurement was taken.

This beautiful object stands on the lawn at Arngomery House, Stirlingshire, and, as measured the other day, its lower branches cover a circumference of 210 feet in a complete circle, while 15 feet of the ends of the lower branches lie close on the ground, with the points turned up like so many young yews. The trunk or stem is clean to a height of 9 feet, with a circumference of fully 12 feet at the middle. It stands 50 feet high, and has a symmetrical pyramid shape, and is closely furnished with beautiful fresh green branches from top to bottom. It is the common variety of yew (*Taxus baccata*), and its age is unknown. Altogether it is one of the most remarkable and picturesque objects of the kind in this part of the country.

A. B.

OUR ILLUSTRATIONS.

SIR,—It being one of the standing orders of the *Journal of Forestry and Estates Management* that contributions are invited on all subjects connected with Forestry, I beg to make the following remarks in regard to some of the "illustrated technics" which appeared in the October number of the Journal. If such illustrations are to be worth anything for practical reference, the outline and leading features of the tools should be as correct as possible. If figs. 3 and 4 of a heavy felling axe are intended to serve as a guide as to shape of axe and the mode of fixing the shaft or handle, I as one who has wrought with tools for the last thirty years, and knows what it is to break a shaft and likewise how to put one in, say unhesitatingly that it is a most unpractical illustration. How any person can fell or hew timber with such a tool I can't tell. There seems to be no edge to it at all—only a piece of unshapen metal. Another thing, the axe is not properly shafted and wedged. The "reed" of the wood which forms the shaft should always be in line with the tool, being the strongest position for resistance; and the wedge which fixes the shaft in the axe should always be put in on line with the reed of the wood and blade of the axe. When the shaft is put in and wedged as shown in the illustration referred to, the shaft is more liable to break, and the wedge is sure to come out and be an everlasting source of annoyance to the axeman.

I have taken the liberty of making the above remarks, not as a fault-finder, but for the credit of Foresters generally; and that the illustrations may be more practically delineated.

JAMES KAY
Bute Estate, Rothesay, October 12th, 1877. *Forester.*

[We have submitted our correspondent's letter to the author of "Technics of Forestry," and give his explanation as being very much to the point. We merely observe that "all subjects connected with forestry," and the various modes in which its operations are performed, will receive due consideration from us; and all suggestions, such as that of our esteemed correspondent, are of much interest and practical value.—*Ed.* J. F.]

SIR,—In subsequent papers I may give sketches of axes used for soft woods, carpentry, wheelwright's work, &c. Mr. Kay is evidently a *soft-wood* axeman, and has his ideas limited by his experience, which is valuable for its length, but lacks breadth. I, however, like the vehemence with which he writes, although he has not looked into the illustrations very closely; and if he were to send a rough sketch of his axe-head and the handle, saying *where* it is broken, and *why* it broke, I have no doubt our views would not be very widely different, at least about the *shape* of his axe-head for *Scotch firs*. I should like him to see the Right Hon. W. E. Gladstone's reply to my letter, finding fault with his using a soft-wood axe to fell an ash. I sent him the illustrations of a hard-wood axe and bill, of which Mr. Kay complains, and he admitted that he was using an old American soft-wood axe, and my observations were "perfectly correct." I shall be pleased to hear again from Mr. Kay, but he must remember the *Journal of Forestry* has a wide range of usefulness, and hard-woods take precedence, as felling such timber requires if anything better tools —*J. C. K.*

SCHOOL OF FORESTRY IN FINLAND.

SIR,—I thank you for giving insertion in the Journal of this month to my account of the School of Forestry in Spain. I send with this an account of the School of Forestry in Finland, and I shall be glad if this you will also publish. I wish to show that in a country of which so little is known here as Finland, as in Spain, the forester finds his place among the learned professions, as he does in Austria and Russia, in Germany and in France ; and to show that in Finland—shall I say *even in Finland?*—as in Spain, an interest is taken in the endeavour we are together making to secure for foresters in Britain and in the colonies a scientific training similar to what is enjoyed by foresters on the Continent.—I am respectfully yours, JOHN C. BROWN.

Haddington, 22*nd Oct.*, 1877.

[We regret that want of space prevents us from inserting Dr. Brown's interesting article this month, but we shall endeavour to do so in the December Journal.—*Ed.* J. F.]

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WHAT TO PLANT.

SIR,—I think that the four qualities which "Plantatunes" requires will be best supplied by the arbor vitæ (*Biotis Occidentalis*). It naturally inhabits swampy places, and might be interspersed (if the climate is genial) with the deciduous cypress (*Taxodium distichum*), which exhibits beautiful glowing tints when fading in autumn, and is of a lively larch green in spring and summer. The spruce tribe are generally tolerant of moisture, not amounting to actual swamp ; but they are somewhat gloomy in a young state. *Abies nigra*, the black spruce, is the best for swamps, and good varieties show much beauty by the contrast of purple cones and glaucous foliage. Of humble growth, not exceeding three or four feet, but revelling in moist shady places, is *Gaultheria shallon*, with arbutus-like flowers, purple berries, and handsome foliage. This, for undergrowth, should be mixed with *Hypericum calycinum*, the large-flowered St. John's-wort. These are all evergreens, but as a rule evergreens are intolerant of excessive moisture. If the inundation is only occasional, many beautiful things will thrive. The *Arbutus unedo* and *Croomii*, the former with white, the latter with carmine flowers, and hollies in variety will succeed. The Common Dogwood, though deciduous, is a fine object in autumn, with its changing foliage and in winter with its bright red twigs.

SALMONICEPS.

SIR,—Under similar circumstances to "Plantatunes" (see page 437), I put in a belt of alternate evergreen oak and various thorns, backed up by English maple and mountain ash, all four of which trees are low and dense in habit. I filled out with larch, silver poplar, and silver birch, to make a screen quickly, the last three named to come out in due course as the first grew-up. Willows and poplars form but a poor screen when the leaves are off. *Quercus ilex* has to be transplanted in a small state, on account of its tap-root. If "Plantatunes" puts in a few *Acer negundo* they will grow quickly, and soon help the plantation up.

C. J. NAYLOR.

Brynllywarch, Montgomeryshire.

THE STORM.

SIR,—It may interest your readers to know that the storm which was telegraphed from America on the 8th October as being on its way to us across the Atlantic broke over this place with the greatest violence on the morning of Thursday, the 11th ult. About nine o'clock, while the wind was blowing steadily from the south-east, a dark cloud was seen gathering in the north, which in a short time assumed a most appalling aspect as it came rolling up almost in the teeth of the wind. The darkness became intensified as a heavy shower of snow began to fall, the snowflakes being seen with great distinctness against the dark background.

At twenty minutes past nine the opposing currents of air seemed to meet at a point near the confluence of the North and South Esk rivers, being nearly the lowest and most secluded part of the grounds within the Park. I will not risk any opinion as to the cause of the phenomena, but can only say that in the short space of two minutes the scene that followed was one of the wildest ever witnessed here. A large ash tree, fully three feet in diameter at the root, had its entire top carried away, leaving a bare trunk standing twenty feet high, and split nearly half-way down. Another ash, not quite so large, had all its branches wrenched off about three feet from the trunk. A fine old oak, a remnant of the old Caledonian forest, was snapped over four feet from the ground, while an elm covered with ivy was torn up bodily by the roots, and these with a great number of branches from other trees were all piled upon each other in the greatest confusion.

A large hay stack standing near by was also seized upon, and its thatch with a large quantity of hay was driven amongst the trees, with all the force of an explosion, the hay and straw being twisted amongst the branches in the most fantastic manner. Indeed, the damage, viewed as a whole, resembled more the effects of an explosion than those of a gale, as it was all confined within the radius of a hundred yards.

The noise made by so much timber falling must have been very great, and yet some men who were sitting at their breakfast in a shed quite close to the place state that they heard nothing but the terrible roaring of the

wind, which drowned the noise of everything else. There is another curious circumstance worthy of notice, namely, that while the fury of the storm spent itself at this particular spot, the tail of the blast appears to have turned off almost at a right angle to the direction in which the trees were blown, as tufts of straw from the stack and boughs and twigs of the trees were found strewn in a straight line for nearly a quarter of a mile towards the south-east.

ROBERT BAXTER.

Dalkeith Park. *Forester.*

SCOTCH FIR.

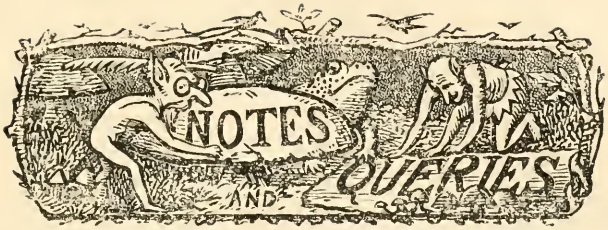
SIR,—At page 439 W. B. H. remarks on young Scots firs dying suddenly after making average shoots the previous year.

That is a very common occurrence among young Scots firs when growing on old Scots fir woodland.

The cause is a fungus; and if he will pull up trees in the dying or sickly state, he will find fungus attached to the roots.

In moist ground there is no chance of trees being destroyed by fungus.

W. M. C.



[*The Editor requests the assistance of Readers in answering Queries, so that the usefulness of this Department may be maintained.*]

Luminous Wood.—"Rotting wood is well known to be often phosphorescent; and some authors state that this does not depend upon the presence of fungi, but seeing the proved occurrence of phosphorescence in the mycelium (spawn) of fungi, it is most probable that the luminosity is attributable to them, especially as it is removed irrecoverably by drying up the damp, rotten wood."—("Henfrey's Elementary Course of Botany," ed. Masters, 1870, p. 624.) The luminosity of fungi "has been observed in various parts of the world; and where the species has been fully developed it has been generally a species of *Agaricus* which has yielded the phenomena." Their luminosity at night "is often so intense as to yield light enough to read by." "Tulasne, who has specially examined the luminosity of the agaric of the olive (*A. olearius*), has observed dead leaves in the south of France to be endowed with the same property, without, however, being able to detect the cause. Fabre, in a paper just (1857) published in Ann. D. Sc. Nat., ascribes it to a temporary increase of oxidation. Beautiful, however, as the effect may be in these instances, it is far excelled by the phosphorescent appearance presented by rhizomorphæ in mines, the splendour of which is described by Humboldt in the most glowing colours." These are imperfect thalloid structures, which exhibit upon their branches points of phosphorescence, sometimes so luminous "as to enable surrounding objects to be distinguished." "They are," the Rev. M. J. Berkeley believes, "mere subterranean forms of common fungi. De Candolle long since explained their real nature; but it is very curious, if this be the case, that our common polypori and xylaria, which give rise notoriously to such productions, are not themselves luminous when perfectly developed." "According to Unger's observations, the light is not emitted from decaying matter, but from a peculiar superficial layer of cellular tissue."—(Henfrey, loc. cit., and Berkeley's "Cryptogamic Botany" (1857), p. 266.) Microscopic observations and experiments on the life-history of these fungi, and the nature of this phosphorescent light, would seem to be still desirable.—*G. S. Boulger, the Posting-house, Hemel Hempstead, Herts.*

As no scientific contributor has answered the question in relation to the phosphoric gases produced by luminous wood, allow me to offer a few

simple suggestions as to the probable cause of it. In the first place, I find that luminous wood (or touchwood, as it is called in Shropshire) will not produce the luminous appearance unless it has been buried in the ground, and suddenly brought to the surface in a moist, damp state, such as your correspondent would perceive in the decayed roots of the spruce fir. Or, again, when the decayed wood is lying on the surface of the ground in a dry state, after a gentle shower, or a good "Scotch mist," the same luminous appearance will be perceived, consequently the gases are not produced when the decayed wood is in a perfectly dry state. Now I believe the gases that are produced from this wood are exactly the same as those which produce the will-o'-the-wisp, so frequently seen in damp, marshy ground. If not so, perhaps some scientific reader would enlighten us more on this subject. It must also be observed that the luminous appearance is not perceived in the daytime, being only visible in the twilight or darkness. I may also add, in conclusion, for those who may not have the chance of seeing touchwood, that much the same appearance, only perhaps not quite so brilliant, is produced by fresh herrings, if they are put upon a plate and placed in a dark room.—*Richard Jandrell, Hawkstone, Salop.*

The phosphorescent appearance on F. Herbert's spruce fir roots was caused by a fungus. I have seen it on a variety of woods after decay has set in. The wood in itself is not luminous. I have scraped off the fungus, and "in an instant a' was dark."—*Andrew Slater, Rose Cottage, Loftus.*

Climbing Trees.—In answer to Mr. Dealy's question as to the best and easiest method of climbing trees, I would recommend the use of *climbing irons*, of which there are several kinds. The best and simplest description of them which I have used is made as follows:—Get a bar of good steel, $\frac{3}{4}$ inch wide by $\frac{1}{4}$ inch thick; then have the longest side of the climbing iron made to reach up the outside of the leg to the knee, and at about two inches from the top have a hole made for a leather strap to go round the leg. A similar hole will also be required near the bottom of the iron, just above the boot, for a strap to go round the ankle. The iron then is made to turn under the foot with a sharp hook projecting from its end inwards. The man, or boy, when he has fastened the irons on properly, walks up to the tree, and, placing both his hands as far round the stem as he can, lifts his foot, and with a smart jerk sideways strikes and fastens the hook of the iron into the bark of the tree. With a slight spring he then fastens the corresponding hook on the other foot as much higher up the tree as he can easily, and so on moving each foot alternately till the desired height is reached. A little practice would be necessary for an amateur to learn to use them with ease and safety in climbing large trees. Let him find a tree to practise on which he can clasp well with his arms, and so guard against any danger of falling. This precaution he will find is not necessary after a little practice. I have had timber fellers who could use them with freedom and ease in climbing large trees, up which they would "swarm," or scramble, nearly as fast as any squirrel.—*R. Jandrell, Hawkstone, Salop.*

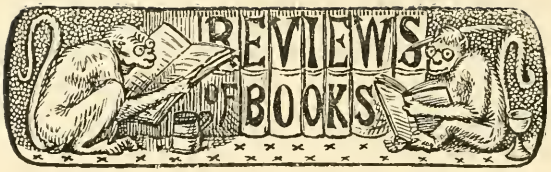
Lime-tree Wood.—It is *not* the case that lime-tree wood kills bees unless you really want to kill them with it, by taking a good stout lime-tree bough and belabouring the poor "busy bee" to death, as we used to serve the wasps and their nests when at school, or in some other similar way. There are few flowers or blossoms that bees are fonder of than those of the lime-tree, or from which they extract more honey of a better quality. —*A. B.*

Osiers.—In reply to "H. S.," the best sort of osier to plant is *Salix viminalis.* The proper distance apart, 2 feet 6 inches each way. Osier cuttings vary in price, according to the locality. I have purchased in Norfolk strong cuttings of two year old shoots at 11s. per 1,000.—*D. D.*

Birch Felling.—In Scotland the best month or months for cutting birch of any age is from the beginning of November to the end of February. The young twigs or branches are then cut and tied up into bundles of about six inches through at the tie, and are in good demand for brooms or besoms for sweeping streets, &c., and realize from 2s. to 2s. 6d. per dozen, delivered in Leith, Edinburgh, or Glasgow. Bass brooms are now superseding birch. It is seldom there is any difficulty in getting a good crop of birch coppice.—*A. B.*

Composition for Preserving Trees from Hares and Rabbits.—Sir,—In reply to "A. B." (see page 440), I beg to inform him that I have used Davidson's Composition successfully for protecting young fruit and forest trees from the depredations of hares and rabbits. It is perfectly safe, and not at all injurious to the growth of the plants, and is not easily washed off by heavy rains, and can be expeditiously put on by an active man. Thoroughly stir up the composition in the cask before using it; then take a suitable quantity in the hand and rub it well over the stems of the plants, drawing the lower branches of the trees also through the hand, as high up as they are within reach of the hares and rabbits. The composition can be had at Messrs. R. Davidson and Co's., Shore, Leith, in casks from 12s. 6d. upwards.—*D. D. H.*

Bitter Willow.—Would any of your valued correspondents say whether they are able to recommend the bitter willow as a hedge plant? I am told its shoots are never eaten by stock, and that they are readily saleable for basket purposes; but I should doubt as to how far it would be a sufficient resistance to heavy cattle. If any of your readers, who can speak from experience, could kindly give me some information on the subject, they would confer an obligation.—*Subscriber.*



The Timber Importer's, Timber Merchant's, and Builder's Standard Guide. By RICHARD E. GRANBY. Second Edition. Lockwood and Co., London.

THIS handy volume forms one of Weale's Rudimentary Series of scientific works, and comprises in a concise and practical form valuable information to the timber importer and merchant on the analysis of deal standards, with comparative values and net landed cost of Baltic and North American timber; a complete exposition of the foreign squared timber trade, lathwood, staves, &c.; with various tables showing the solid, lineal, and superficial quantities; particulars of freights, insurance, duties, and expenses of importation; and the cost in dollars, currency, and sterling. To the builder it gives copious and useful information, with tables setting forth the net cost and workmanship per piece, square, lineal, or superficial measure, of all builders' and artificers' work.

The Complete Measurer. BY RICHARD HORTON. Third Edition. Lockwood and Co., London.

THIS valuable work has been compiled with a view to afford our legislators and the public an opportunity of introducing for general use, correct and convenient Tables and systems for measuring timber, stone, &c., in lieu of those now extant, which are in many instances productive of serious loss to the seller, whilst in other cases giving results causing heavy loss to the purchaser.

Urged by a strong impulse to combat the obstacles opposed to the introduction of proper systems and tables, and convinced that at the present day the minds of men of business are expanding with the times, and more inclined than formerly to changes which are consistent with truth and generally beneficial, the author has set to work in earnest and produced a handy book that will be highly prized by all foresters, timber merchants, builders, and others, whose duties require exact measurements of timber, stone, or artificers' work; and we hope the system of measurement advocated in this book will soon be adopted for general use throughout the country, and entirely supersede the present faulty and haphazard system.

In carrying out his system, the author has judiciously followed to some extent the form of tables published by Hoppus, as they are those

most commonly in use, which will enable those who have used them the more readily to comprehend the new system. The tables published by Hoppus have been greatly improved and extended in this work, and two entirely new tables compiled for it—first, "a table for measuring unhewn, that is round or cylindrical timber, extending in length from a quarter of a foot to fifty feet, and in its quarter girths from one inch to sixty-one inches;" and secondly, "a table for measuring hewn or octagonal-sided timber, extending in its lengths from a quarter of a foot to fifty feet, and in width of its sides from one inch to thirty-one inches."

The Tables are interspersed with valuable hints and explanations, making them clear and easily understood by the merest tyro. An excellent chapter gives an easy and concise method of measuring and valuing growing timber trees, pollards, and saplings, for which purpose a specimen of a capital form of Field Book is given, and, under the title of "Miscellaneous Remarks," judicious instructions are given on the precautions to be observed in girthing trees; modes of computing the contents of various shaped solid bodies; how timber is increased in quantity by additional measurements; a good form of noting down the dimensions of trees, &c.; a form of entering trees in the field book according to their respective classes; a table shewing the number of planks required to make a load or ton of timber; and a ready method to ascertain the value of timber.

We recommend the book to the notice of foresters and all who buy or sell timber, who will find it a handy, correct, and valuable companion.

The Colorado Potato Beetle. By Dr. Andrew Wood, Lecturer on Zoology, &c., in the Edinburgh Medical School. W. and A. K. Johnston, Edinburgh and London.

A carefully got up shilling pamphlet upon this all-absorbing subject, illustrated with the most natural and correctly coloured drawings of this famous insect in all its various stages—from the egg to the full-grown beetle—which has yet been put before the British public. The insects are shown in their natural size upon the potato plant, and also in a highly magnified state, beautifully and correctly coloured, so that "he who runs may read;" and as the illustrations have been drawn from life with the greatest care, they may be safely relied on as perfect fac-similes, and a trustworthy guide to the identification of the true Colorado beetle. The letter-press describes, in a terse and lucid style, the history of the beetle from its first discovery, about the year 1824, by Messrs. Say and Nuttall in the upper Missouri region, to the present day, when it has become the bugbear of Europe; clearly explains its life-history, and the causes which favour its spread, and its prodigious powers of reproduction; describing its natural enemies, and the best chemical and mechanical remedies against the devouring ravages of the notorious pest; and in concluding the author makes the following common-sense remark, that "whilst the vitality and powers of increase of the Colorado beetle are undoubtedly very great, there xists certain natural provisions already detailed, in the shape of bird and in

sect foes, unsuitable climate, and other conditions, which operate powerfully against the pest; and although there exists every need for stringent regulations, and for the exercise of due precaution against its inroads, some satisfaction should be felt in knowing that the repression of the Colorado beetle is by no means to be ranked in the category of vain hopes." "Knowledge is power," and we would recommend agriculturists and all others whom it may concern to possess a copy of this useful and accurate pamphlet, so as to know and be prepared to meet the foe, should he unfortunately establish himself in our potato-fields.

Some Edinburgh Nurseries.

For the convenience of many of our readers who will probably be visiting Edinburgh shortly on the occasion of the Scottish Arboricultural Society's annual meeting, we append a few notes on some of the Nurseries in the vicinity of the city, which they will probably take the opportunity of visiting. In the limited space at our command we can hardly do more than indicate where the Nurseries are situated, and what arrangements their proprietors are making for the present season, but we shall hope at some future time to return to the subject, and give a full, adequate description of all the great Nurseries of the country.

THOMAS METHVEN AND SONS.

This establishment deals extensively in every department of the nursery and seed business; for the carrying on of the latter branch they have two warehouses, one at 15, Princes Street, and the other at their nursery, Leith Walk. The nurseries, which are situated in the suburbs of the city, contain in the aggregate considerably over a hundred acres. In the Leith Walk Nursery there is a large and varied stock of forest trees, fruit trees, shrubs, and florists' flowers, beside greenhouse and stove plants; here are also raised annually several thousands of grape-vines, for which there has been for many years a steadily increasing demand. The Inverleith Nursery, which covers an area of thirty acres, is almost exclusively devoted to the rearing of forest trees: one of the specialities here is Scots fir of all sizes, grown in large quantities. None but the true Highland variety is sown, the cones being collected in the native forests and the seed taken out in the establishment by kiln drying. At Gogar Nursery, six miles to the west of the city, forest trees are also grown. It is about twenty acres in extent.

The Warriston Nursery is opposite the entrance to the Royal Botanic Gardens, Inverleith Row, where the Scottish Arboricultural Society meets. Here, in addition to a large collection of greenhouse and stove plants, are grown specimens of nearly all the hardy conifers in cultivation. This department of the trade receives special attention. All the various species and varieties are grouped so as to exhibit their ornamental qualities to the best advantage.

Great prominence is also given in the various nurseries to rhododendrons

and other American or peat soil shrubs. Novelties are constantly being added to the collection. Large quantities of hybrids and species are annually raised from seed, and the named kinds propagated by grafting.

We would add that the firm has secured the lease of a field to the west of the Inverleith Nursery, with a view to meet the increasing demand of the forest tree business.

Messrs. Methven and Sons have recently published a catalogue of seedling and transplanted forest trees, Coniferæ, ornamental trees, &c., in which the most important novelties as well as all the old favourites are well represented.

DICKSONS AND CO.

The Nurseries of this firm, which have been long well known throughout the country, are situated in various parts of the suburbs, and cover an area of some 80 to 100 acres, in which are to be found almost every variety of forest trees, fruit trees, ornamental trees, shrubs, rhododendrons, besides Alpine, herbaceous, and hothouse plants, &c. The general offices of the firm are at 1, Waterloo Place; and perhaps their most important nursery is at Pilrig Park, Pilrig Street, close to Bonnington Toll-bar. This land has only been in use as a nursery for about two years, and was acquired in consequence of the Messrs. Dicksons having to give up the old and famed nursery in Leith Walk, of which they had been in possession for upwards of a century and a quarter; and although no doubt the firm were loth to leave their old quarters, yet the manifest improvement in all the plants since they have migrated from the smoky atmosphere of The Walk must be substantial consolation to them. The advantage of having a nursery laid out on one homogeneous plan, instead of growing piece by piece, with constant alterations and additions, as the majority of nurseries do, is here very apparent in the good order and systematic arrangements which are everywhere noticeable. In this nursery are the principal hothouses; and much attention is also devoted to house plants, ornamental trees and shrubs, bedding violas, and pansies, as well as forest and fruit trees, &c.

Redbraes Nursery, which is in close proximity to Pilrig Park, is devoted principally to ornamental trees and shrubs, vines, fruit trees, rhododendrons, and other plants for game coverts.

At Logie Green we find a good and varied collection of forest trees and fruit trees, all in beautiful health.

Bonnington Farm is devoted exclusively to forest trees, all looking strong and healthy.

Quarry Holes is another nursery given up entirely to rearing forest trees.

And lastly, Liberton, where fruit trees of almost every species receive special attention, and make robust and well-matured growth.

PETER S. ROBERTSON AND CO.

In the Nurseries of this firm, which cover an area of some fifty acres, in the vicinity of the city at Trinity, Inverleith Mains, and Stanley

Road, is to be found a choice, varied, and extensive selection of forest trees and shrubs for covert, seedling and transplanted firs, pendulous trees, coniferæ, ornamental hardy trees and shrubs, and a collection of ash, beech, birch, chestnut, oak, sycamore, and other trees specially prepared for planting avenues, parks, hedgerows, &c. Less attention is here paid to hothouse plants than in many nurseries, but the grounds being open and near the sea, are found particularly suitable for all the descriptions of forest trees acclimatised in this country.

Among the conifers many of the larger sizes have been frequently transplanted, and have well-shaped heads and fine roots, enabling them to be sent out with perfect safety and the greatest ultimate success.

The small seed stock of Mr. Gorrie's new tree mallow (*Lavatera arborea*) has been placed in Messrs. Robertson and Co.'s hands; and if the extraordinary yield from this plant, which was reported in the last volume of the Highland and Agricultural Society's "Transactions" has been sustained, we should think they would have no difficulty in disposing of it.

Descriptive catalogues of forest trees and conifers, shrubs, &c., also one of Dutch flower roots, and another of garden flowers and seeds, can be obtained from the offices of the firm at 33, St. Andrew Square, Edinburgh.

DOWNIE AND LAIRD.

The principal establishment and offices of Messrs. Downie and Laird are at West Coates, Haymarket, but their nursery is at Pinkhill (which has recently received an addition of some ten acres, under the name of Meadow Park), about two miles west of Edinburgh on the Glasgow road, where great attention is given to the growth of every description of hot-house plants, ornamental trees and shrubs, and forest and fruit trees, under the personal supervision of the senior partner, who resides on the spot.

It is to the enterprise of Messrs. Downie and Laird that Edinburgh is indebted for the Royal Winter Garden at West Coates, which was constructed by them at a cost of £3,000, and was opened to the public with considerable ceremony by the Lord Provost in 1873. Here is always to be found a fine and varied collection of seasonable flowers and plants, besides ferns and ornamental shrubs, which cannot fail to make a visit to the Winter Garden a pleasant one at any time.

Experiments with Safety Blasting Powder near Jedburgh, N.B.

THE following report, taken from the *Jedburgh Gazette*, of some experiments with *Tonite*, given on the estate of the Marquis of Lothian, may be interesting to many of our readers who have land to clear of tree-stumps and boulder stones :—

A series of interesting experiments with a new kind of blasting powder ("tonite") was performed by Mr. Thomas Dineen, F.R.G.S., in the presence

of a large number of spectators. Mr. Dineen, by request of Mr. Otto, factor to the Marquis of Lothian, had come from Leeds to exhibit the peculiar qualities of this powder, which has not the explosive tendencies of nitro-glycerine or dynamite; and the place selected for the experiments was a field belonging to Mr. Monro, of Fairnington. Among those who were present to witness the experiments were—Lord Lothian; Admiral Elliot, The Kirklands; W. E. Otto, Esq., Jedneuk; Mr. John Monro, Fairnington; Mr. Riddell, Hundalee; Mr. Riddell, Menslaws; Mr. Weaver, Ancrum Bridge-End; Mr. Lyle, Nisbet Mill; Mr. Ormiston, Newton; Mr. Scott, Oxnam Saw-mill; Messrs. Hymers, contractors Ancrum; Mr. Bell, Muirhouselaw; &c., &c.

In this field, which is generally known as Fairnington Moss, but which has been for some time reclaimed and cultivated by Mr. Monro, there are several heaps of large boulder stones, several of them weighing about two tons. They are hard whinstone, and very difficult to break. The first experiment took place at a heap which adjoins the estate of Sir William Scott, of Ancrum. Here, there was a boulder of about a ton weight, which had been bored for the reception of a two-ounce cartridge. After the cartridge was inserted a large stone was placed on the top of the hole in order to give as much resistance as possible to the explosive power of the powder. In the space of a few minutes all the arrangements were completed, and the spectators retired to a safe distance. Three minutes after the fuse had been lighted a loud report was heard, and fragments of stone shot high into the air. Upon examination it was found that the boulder had been shattered to pieces. To prove the safety with which this powder can be used, Mr. Dineen then cut a cartridge in two, and, setting fire to one part, which he held in his hand, it burned out harmlessly, showing no symptoms of an explosive character. The boulder which had been shattered was charged with a two-ounce cartridge, costing threepence, and it may safely be said that it would have taken a whole day to break it by means of manual labour. While the strength of this invention is much greater than that of ordinary blasting powder, its price is much less. Thus two shillings' worth of the former would perform the same amount of work as four shillings' worth of the latter. One peculiarity of this powder is that no ordinary amount of concussion will explode it, and that it can safely be subjected to a heat of 250 degrees. It will not ignite under a heat of 400 degrees Fahrenheit.

The next experiment was with a similar boulder embedded to some depth in the earth. In this instance the earth was excavated to the depth of a few inches below the stone, and the result of the explosion was that it was rent in several places. In all probability the boulder would have been thrown up into the air had there been sufficient resistance below the powder, which, like dynamite, has a downward tendency, but the softness of the ground modified to a considerable extent the action of the powder. The third experiment was with a boulder which might have weighed about 10 cwt. It was thrown up a distance of nearly four feet, by a three-ounce cartridge, and fell broken in two pieces, which were so rent as to be after-

wards easily split up. The party then proceeded to a large heap of boulder stones in the middle of the field, where a novel experiment was tried. Placing three cartridges upon the top of a similar number of stones, Mr. Dineen caused three boulders to be placed above them, with the evident intention of breaking the lower and upper stones. These were purposely undercharged to show the power of the powder. After the explosion it was discovered that although the upper stones had been broken into fragments, very little damage had been done to those on which the cartridges rested. This, no doubt, proved that the powder could be used successfully without any boring, but it showed likewise that with very little labour a boulder could be shattered by the simple process of laying a cartridge upon its face and covering it with a shovelful of clay. The seventh experiment was with three stones weighing in the aggregate about two tons. Holes had been bored four inches deep, not below, but in the face of these ponderous masses, and each of them was charged with a one-ounce cartridge, the cost of which is three-halfpence. Two of them were rent in twain, fragments of *débris* flying high into the air, while the other was cracked in several places. In all, eleven experiments were tried with these boulders, some having been bored from the top, others from the side, and the rest broken simply by the explosive power of the powder, which was placed either below or on the top of the solid pieces of stone. The gentlemen present expressed themselves highly satisfied with Mr. Dineen's experiments.

The company then adjourned to a plantation which runs along the margin of the new carriage drive belonging to the Marquis of Lothian, where a huge tree-stump lay deeply and firmly embedded in the ground. The surface of this stump exhibited no signs of decay, but, on the contrary, suggested the idea of being impregnable to the shock of a large amount of blasting powder. A large hole had been made in the soft earth immediately in the front of and below part of the root. Into this aperture Mr. Dineen put six cartridges containing about twenty ounces of powder. The soft earth was then placed over the hole and firmly pressed against the cartridges, the fuse, of course, appearing a few inches above the surface. Those present, knowing the great power of the charge which had been placed below the last remnant of this monarch of the wood, sought shelter behind the surrounding trees, and after a lapse of about three minutes a tremendous explosion followed, accompanied by a shower of leaves, earth, and splinters of wood. One of these splinters was thrown a distance of seventy yards, and weighed about two stones. Another was found at a distance of no less than one hundred and twenty yards, and weighed upwards of a stone and a half. The shock caused the earth to tremble within a radius of about fifty yards, and the sound was heard at a distance of four miles.

Further experiments were next made at Harestanes with loose stumps of trees. The first experiment of this series took place at Harestanes road-head. Three holes had been drilled into the more solid parts of the wood in order to obtain the greatest possible amount of resistance. A single cartridge having been placed in each of these, and the holes having

been closely pressed with earth, the fuse was lit, and the whole of the tree stump was shivered in pieces, the heavier fragments falling asunder on the road. Proceeding to the foot of this road, the party next inspected two formidable roots, one of which weighed about two tons. Further away were two of a smaller size. These were safely exploded in the manner described, but the most satisfactory as well as the most destructive evidence of the power of this new explosive was given by the manner in which two tons of wood were scattered about the road like hailstones. One piece struck an oak close by, ripping open the bark and making an indention in the trunk of the tree.

The last trial took place in a field adjoining the road leading to Mount-eviot from the Anerum turnpike. Two pieces of iron rail, about two feet in length, were there laid side by side. Upon the face of one of them three cartridges containing ten ounces of powder were placed. Then, on either side of the cartridges, which were tied together, pieces of sod were laid in order to present a sufficiently level surface for the other piece of metal, which was placed upon the top. It was understood that this was the most crucial test which could be devised for the purpose of ascertaining the strength of the powder. The road, it should be here explained, was distant about two hundred yards from the spot where the pieces of rail were lying. The company lost no time, after the fuse had been lit, in retiring to a safe distance. A report like thunder followed, and after the noise of the explosion had died away, a strange whirring sound, similar to that made by a shell when passing through the air at a great speed, was heard, followed by a dull heavy sound. On going to the spot where the rails had been placed, it was found that they had been broken in several pieces, and that the greater portion had disappeared. Search was then made for the missing fragments, but although several men standing at a distance heard the sound of some solid body striking against some tree in a wood close to the road, no trace could be found of any of the pieces of iron. The report was heard at a distance of five miles.

Mr. Otto and a number of those who had witnessed the experiments complimented Mr. Dineen on the success which had attended his efforts to illustrate and explain the uses and advantages of the powerful explosive for which he is the agent. The great feature of this new invention is that it does not explode when not confined by any resisting bodies. A cartridge will burn like a piece of paper if held in the hand, without in any way proving dangerous, or being offensive in smell.

Altogether the experiments were highly successful, and were watched with great interest by all present.

[Since the above was written a piece of the iron rail has been found four hundred yards away from the scene of the explosion, and another piece has been found at a depth of two feet below the surface of the earth.]

The Right Honourable W. E. Gladstone as a Woodward.

A WELL-EXECUTED photograph of the ex-Premier as a woodward has been recently published.

As a speaking likeness it is excellent; the position is of the self-imposed toiler seated in front of a tree he has been labouring at, and made some progress towards felling, as evidenced by the chips around him. It appears to be an ash, doubtless the one the newspapers stated to be fifteen feet in circumference, in his park at Hawarden. On that occasion he spoke of waste products being utilized and becoming a gain instead of a loss. Of course this gentleman's aim is to maintain robust health more than to make a display of a forester's ability except as an exemplar, to give dignity to hard toil. England may well be proud of such a statesman and scholar. He finds that the mere effort of redundant eloquence is inadequate to carry off the massive energy of his nature, but the stalwart strokes of his axe fittingly serve for that end.

By the far-reaching gaze his thoughts are shown not to be on his work but grasping a world's action by power of thought.

A working woodward would take exception to the double curved handle to his ae, and to the axe having too much "heel" to the blade, for hard wood, two technical defects which a woodward's axe should not have: such a tool might do for lopping, but it is not an axe a woodward would select for felling an ash. In fact, for a tree half fifteen feet in circumference, no forester who knew his business, and the value of time and timber, would think of chopping a hardwood tree down, but would use the saw, and with a mate or two would economize time, and save timber of more market value than the freehold ground the tree stood upon, and ensure a better and safer fall.

Amateur foresters are apt to accept the tools offered them for use, in the same manner as gentlemen ride out with just the bits, and stirrups, and saddle gear the groom chooses to give them, often with sad results.

When this great thinker and hard worker shall have devoted a little time to the technics of toil, he will find fair scope for energy of thought, which might help to raise the humble labourer to the grade of an artisan, and give to the student the capabilities of the workman. At present the high barrier between the student who works and the toiler who thinks is books—and the very books which should be a zone of light for the pathway of both; in these the simplest science is often mystified by pedantic jargon or nonsensical brevity; requiring an expert to elucidate or dictionaries to define. Time adds to the accumulation, making of science a barrier to knowledge of truth by the worker, utility by the thinker, and beauty to both.

Special trade journals are unostentatiously diffusing correct and comprehensive knowledge amongst the toilers, exalting their aims to truth, usefulness, and beauty in their track of every-day toil. J. C. K.

Wellingtonia gigantea pendula vera.

Amongst the many new and rare plants exhibited at the recent International Show at Carlisle, perhaps none attracted so much attention, or is more likely to be sought after by all lovers of Coniferæ, than the beautiful specimen of the new weeping variety of *Wellingtonia gigantea* exhibited by Messrs. Little and Ballantyne, of the Knowefield Nurseries, Carlisle. Our

illustration is from a photograph of the plant taken in the autumn of 1876, but it hardly does justice to this really fine novelty as seen by us in September last; the original plant itself looking very much more handsome, and displaying a vigour of growth and closeness of habit equal to the best specimens of the common variety. This thoroughly

distinct and elegant variety of the *Wellingtonia* was raised from seed in the Knowefield Nurseries some eight or nine years ago, and since then its very distinctive and striking character and habit has always remained the same. The stock of young plants have all been propagated by grafts or cuttings, so as to ensure the transmission of the characteristic features of the original plant, and those who purchase it may safely depend on getting the true variety.

As was mentioned in the Journal last month, the first prize for the "best new hardy conifer of real merit" was awarded this plant at the International Show, and the crowds of visitors who inspected it during the three days, many of whom we knew to be good judges and had an opportunity of conferring with, coincided in our opinion that it is destined to become a very desirable acquisition to our already extensive list of choice hardy Coniferæ; in fact, no collection can be considered complete without it. We learn that it is being sent out this autumn, and we cannot too strongly recommend it to the notice of our readers. It is a novelty that is destined to advance in popularity the larger it grows and the better it is known, and its merits become thoroughly understood and appreciated.

Jubilee of Mr. Robert Foulis, Forester, &c. Fordell, Fife.

On the afternoon of Tuesday, the 16th October, Mr. Robert Foulis, gardener, forester, and estate overseer at Fordell, Fireshire, was entertained at dinner in the Albert Hotel, Edinburgh, and presented with a gold watch and a purse of sovereigns, on the occasion of his having completed his fiftieth year in the service of Mr. G. W. M. Henderson. He was also presented with a handsome gold brooch for his wife. Bailie Methven occupied the chair, and Mr. Dunn, of the Dalkeith Palace Gardens, was croupier. Amongst others present were—Mr. France, Penicuik; Mr. Sadler, Royal Botanic Gardens, Secretary to the Scottish Arboricultural Society; Mr. M'Leod, Superintendent of the Edinburgh Public Parks and Gardens; Mr. Thomas Gibson (of Messrs. Gibson and Sons), Bainfield; Mr. Roland, Crossgates; Mr. Low, Mr. Downie, and Mr. Laird (of Messrs. Downie and Laird, Edinburgh); Mr. G. Crichton, jeweller, Treasurer to the Scottish Arboricultural Society; Mr. J. Alexander, jun. (of Messrs. Dicksons and Co.); &c. &c.

After the usual loyal and patriotic toasts, the Chairman proposed "The Health of Mr. Foulis." He said that they had met on a very rare occasion indeed, for it was seldom that any one was found who had served for fifty years in one place as their friend had done, and with so much honour to himself. He had been nominally a gardener, and connected more especially with horticulture, but he had not confined himself to that branch of science alone. He had taken a deep interest in arboriculture,

and had left his mark on the Fordell estate, which was noted throughout Scotland, and he might say in Great Britain, for all kinds of hardy plants. He had also taken a deep interest in geology, and had done much to communicate the knowledge he had acquired to younger men. He first became acquainted with Mr. Foulis in 1835, and since that time he had always had a kindly feeling towards him. He had great pleasure in making the presentation to Mr. Foulis, and hoped that he might long be spared to enjoy his retirement. The toast was cordially received, and Mr. Foulis, upon rising to return thanks, was loudly applauded. He said it was gratifying to him to think that, after having lived amongst friends for fifty years, at the end of that period he was esteemed and respected by them. He felt that the merit attached to the position in which he was now placed was principally due to Mr. Henderson, who had proved a most excellent, kind, and indulgent employer, and one who had done a great deal to improve his estate. Although he had been a long time at Fordell, he had not attained to the length of service of his predecessor, who was gardener and forester there for 63 years—making 113 years in all between them. The Croupier proposed in an appropriate speech "The Health of Mrs. Foulis," which was most heartily responded to, and to which Mr. Foulis replied in very feeling terms. Mr. Thomas Gibson then gave "The Health of Mr. Foulis' Family," and Mr. Downie proposed "The former *employés* under Mr. Foulis, at Fordell." Mr. Wallace, Luscar, returned thanks, and bore testimony to the high character of Mr. Foulis, and the esteem in which he was held by those who had the pleasure to serve under him. Amongst the other toasts proposed were—"Success to Horticulture," by Mr. France, and responded to by Mr. M'Leod; "Success to Arboriculture," by Mr. Gordon, and replied to by Mr. Crichton; "Success to the Nursery Trade," by Mr. Sadler, and responded to by Mr. Laird; "The Secretary and Treasurer," Mr. Hunter; "The Chairman," "The Croupier," &c. The watch was supplied by Mr. Bryson, and the brooch by Messrs. G. & M Crichton, Princes Street, Edinburgh.

Mortal Combat between a Fox and a Swan.—A sanguinary fight, writes a Kent correspondent to the *Aberdeen Free Press*, took place recently, in the early morning, on the borders of the ornamental water near Sherborne Castle. A swan having gone walking over the grass, picking up, as they do, whatever may be about, was dropped on by a fox, who possibly thought it was a goose; and the marks on the grass for a considerable space showed that a very determined fight had taken place, as both were found dead within five yards of each other, the fox with his skull split open, and the swan torn about the neck and back. The swan was about thirty years old. The fox was a young one.

Scottish Horticultural Association.—A monthly meeting of the Scottish Horticultural Association was held on 2nd October, at No. 5, St. Andrew Square, Edinburgh; Mr. Fraser, vice-president, in the chair. A paper was read by Mr. Robert Lindsay on "Root Propagation," in which the writer gave it as his opinion that there were many more plants than was generally supposed that could be raised from root cuttings, and detailed the results of a series of experiments he had made as to the plants that lent themselves to this method of propagation, stating that it was only by trial that the feasibility of the system could be proved in any particular case, as there was, so far as he could see, nothing about the appearance of the roots to indicate whether or not they would propagate. As an instance of what could be done by this method of propagation, he mentioned that the Indian Government had been supplied with the ipecacuan plant entirely from roots sent out to that country from the Botanic Gardens and Messrs. Lawson's nurseries. In the course of some discussion which followed the reading of the paper, Mr. Sadler submitted that the subject was a most interesting one, and worthy of being fully inquired into, and Mr. Grieve mentioned that his experience was that coniferous plants were the only class that would not propagate from root cuttings.

Beeches in Devonshire.—In the south of Devon the beech trees are loaded down to the ground with nuts. I never saw such a bearing before. The trees have an elegant appearance, and the squirrels have a fine time of it, for not only the beech-nuts but the hazel-nuts are abundant; but acorns are very scarce.—*Journal of Horticulture.*

Sale of a Perthshire Estate.—The estate of Ardargie, situated near Forteviot on the banks of the river May, and extending to about 962 acres, of which 565 are arable, 17 policy grounds, 154 pasture, 207 woodland, and 19 houses roads, &c., was disposed of recently by public auction in the rooms of Mr. Dowell, George Street, Edinburgh. The reduced upset price of £30,510 was offered by Mr. John Panton, writer, Blairgowrie, and the estate was sold to that gentleman for the sum named. Mr. Panton, it is understood, made the purchase on behalf of a client.

The sale of the estate of Greenlaw, in the parish of Crossmichael, Kirkcudrightshire, was adjourned, the reduced upset price of £60,000 not being offered for it.

Sale of Lands near Lockerbie, Dumfriesshire.—The farm of Catlinns and the lands of Byresteads have lately been purchased by Mr. Archibald Stewart, W.S., 17, India Street, for Mr. Andrew Jardine, of Corrie.

The lands of Swyre, parish of Dunscore, Dumfriesshire, extending to 268 imperial acres, nearly all arable, were exposed for sale on the 10th October, in the King's Arms Hotel, Dumfries, at the upset price of £3,000, and sold at that sum to Mr. James Beattie, of Newton.

The farm and lands of Haugh of West Grange, Stirling, have been sold to Mr. Alexander Thomson, Aberdeenshire, at £3,675, or £425 more than the upset price.

Traction Engines on Country Roads.—The Rye Highway Board has resolved upon a course with regard to traction engines travelling within its district which, if legal, and if followed out by other authorities, will virtually abolish a traffic which has lately grown to considerable proportions in country districts. Acting under the advice of counsel, the Board has decided to prosecute the owners of all traction engines, with "rough-soled" wheels, which shall be found travelling in the district after the 15th of the present month. As it is impossible for the engines to proceed under certain circumstances if the surface of the wheels is not of the ordinary rough description, the question will arise whether the discomfort and expense caused by the traffic do or do not outweigh the advantages which it affords to the public.

Mr. James Wilson has just sold to Mr. James Reid, Peterhead, the estate of Hayfield, lying in the neighbourhood of Peterhead, and consisting of 63 acres, with mansion-house, steading, &c., for £4,400.

Effects of the Winter of 1860-61 on Shrubs at Penrose, Cornwall.—August, 1860, was cloudy and wet (21 days' rain), and summer shoots of shrubs were not ripened properly. Winter began early, and half-hardy shrubs, whose young branches were still full of sap, suffered severely in Cornwall, whilst the same kinds survived the winter in the suburbs of London.

Shrubs killed at Penrose.

Abutilon vitifolium (some).
Acacia lophantha (all).
Araucaria brasiliana (all).
Arundo Donax.
Benthamia fragifera (some).
Cineraria arborea.
Cedrus deodara (some).
Daphne purpurea.
Juniperus flaccida.
Mesembryanthemums (all).
Olive.
Paulownia imperialis (all but one).
Physianthus albiflorus.
Piptanthus.
Pittosporum.
Thuja Donneiana.
Veronica picta (all).

Died back, but recovered since.

Acacia dealbata.
Deciduous Cypress.
Humea.
Rosa Macartneyana.
Viburnum suspensum.

Injured.

Azalea (various).
Benthamia fragifera (all, and some killed).
Cedrus deodara.
Hydrangea.
Hydrangea japonica.
Liquidambar.
Rhododendrons (some).

Uninjured.

Araucaria imbricata (all).
Camellia japonica.
Juniperus (various, except flaccida).
Phygelia Capensis.
Pomegranate.
Rhododendron ponticum.
Thuja Nepalensis.

Injury to trees was not generally registered, but Pinus Austriaca suffered much more than Pinaster. Pinus insignis suffered from snow.—John Jope Rogers.

Chestnut Trees.—A small black fly, species unknown, has made fell havoc amongst the chestnut trees in some parts of the Pyrenees of late years. Bark and wood alike have been destroyed on the finest trees. The destruction is described as "immense," and the insect is said to be extending its attacks to the neighbouring oaks.

Desfontainea Spinosa in Scotland.—At the Marquis of Tweeddale's fine old gardens at Yester, in Haddingtonshire, is a noble plant of this in flower in the open air. It is about 4 feet high, and nearly as much through, and bears numerous flowers. It is growing in a pot, and set out in the open air in summer, and no doubt protected in winter in a cool house. In this way this brilliant plant is well worth growing where it does not thrive out of doors, such as it does in Wales, the south of England, and Ireland.

Is Gas Tar Injurious to Trees?—My experience entirely justifies Downing's recommendation of the use of gas tar as a preventive of the attacks of rabbits upon the bark of newly planted trees. I have used gas tar, sometimes mixed with a little benzoline if very stiff, for twenty-five years for ash trees, oak, larch, ivy, and other plants, without being aware of a single instance of injury. It has even been applied without injury to parts of the stem which have been already bitten and laid bare, whilst I never knew rabbits touch plants which have been so treated. I have also tarred the cuts of trees of all ages, after removing limbs close to the trunk, to keep wet from decaying the timber, instead of paint, with good effect, especially if the limbs are cut off in early summer when the sap is rising.—*J. L. Rogers, Penrose, Helston.*

Preserving Posts.—In reference to this subject, Mr. C. A. Wheeler, of Gloucester Villas, Swindon, writes:—I have experimented upon larch posts; and, in order to their preservation, I simply invert them. I have often done so; and after many years, when taken out of the ground, they were not only sound, but all that portion which had been under ground bore so much the nature of petrifaction that it was impossible to cut or saw it. The soil was clay. It has ever seemed to me thus accounted for: as sap ascends the trunk of a tree by capillary attraction through the pores nature supplied for the process, and as the trunk of the tree had been reversed, so would the action and "determination" of sap to the root be the result. Though forgetting where I learned it, I well remember once before laying these remarks before the public. It should be remembered that, as decay of posts is generally between wind and water, through evaporation, the descending moisture leaves nothing to so evaporate.

Irish Plantations.—According to the recently issued agricultural returns, the acreage of land, underwoods, and plantations in the several provinces of Ireland is as follows:—

		Acres.
Leinster	1876	101,358
	1877	100,334
Munster	1876	106,759
	1877	108,437
Ulster	1876	62,811
	1877	64,739
Connaught	1876	53,224
	1877	54,903
Total	1876	324,152
	1877	328,413

Last month we had the gratification of calling the attention of our readers to the then approaching Annual General Meeting of the Scottish Arboricultural Society, and we have now the honour and pleasure to congratulate the Right Hon. President and Council upon the marked success of their endeavours to make the recent meeting thoroughly instructive and interesting to the numerous attendance of members and others interested in arboriculture, who were present from all parts of the country. From the commencement of the proceedings till their close, a period of fully four hours, the interest and attention never flagged, which was, no doubt, in a great measure due to the stimulus given to the proceedings by the excellent and appropriate opening address of the President. For many years the Society has been most fortunate in being presided over by gentlemen who thoroughly understand, and take the deepest interest in arboricultural matters; and under the able guidance and presidency of such a thorough practical forester as the Right Hon. W. P. Adam, of Blairadam, M.P., the Society's beneficial influence is certain to extend to the remotest parts of the British Empire; encouraging the proprietors of land, both by sound advice and judicious example, to adorn their estates with a due amount of nature's verdant clothing; thus enriching the scenery, ameliorating the climate, and tempering the blast; rendering their estates far more lovely and habitable; and last, but by no means least, adding vastly to their pecuniary value.

Now that the Society has so firmly established itself, and can show such a goodly roll of members, we trust that it will not much longer delay taking the excellent advice of its President, and accepting his graciously proffered aid to lay its claims before the proper authorities,

so as to enable it at an early date to enjoy the benefits of a Royal Charter, which is the only thing now wanting to render the Society one of the permanent, as it is now one of the leading institutions of the country. We also trust that the well-timed and judicious remarks of the President, upon the great necessity for something being done for the early establishment of a School of Forestry in this country, will have its due weight with the members of the Society, and stir them up to take an active interest in a matter that so deeply affects the future of forestry in the British dominions. This subject was afterwards prominently brought before the meeting in an interesting paper read by our able correspondent, the Rev. J. C. Brown, LL.D., and we are gratified to see it set down for one of the subjects to be discussed at the next Annual Meeting; but in the meantime we would much like to see the Council, as representing the Society, and comprising some of the ablest and most experienced members, taking an active and leading part in promoting the establishment of a Forest School. The advice and influence which the Council could bring to bear upon this important matter would be invaluable towards its speedy accomplishment, and no hesitation should be made in using it when it involves the Society in no pecuniary responsibility, and is of such vital importance to the future prosperity of British forestry.

As we give in another place a full report of the meeting, we need make no farther comment than to say that the arrangements for conducting the business were most complete, and satisfactorily carried out under the active superintendence of the experienced and energetic Secretary, Mr. John Sadler, F.R.Ph.S., and to wish the Society the utmost success in its future proceedings, which it has so well merited in the past by its praiseworthy and persevering endeavours to stimulate an interest in forestry, and to spread a knowledge of its best principles throughout the length and breadth of the land.

THE deep interest taken by our readers in the various methods of seasoning and preserving timber, fence-posts, &c., from rot and premature decay, has been fully evinced in our pages during the last few months, and shows the great importance of the subject to foresters, and all others who have the construction and keeping in repair of buildings and wooden erections upon landed estates, or the supply of timber for the various wants of railways, mines, &c., where fungoid rot, and consequent quick decay, causes such a waste in timber, and a heavy expense in having so often to renew it. Our attention has lately been drawn to a new process of seasoning and preserving timber, which we think is likely to be found much more efficient and generally applicable than any of the methods formerly in use.

The inventor and patentee of the process is Mr. D. Gardner, of the firm of Messrs. A. Gardner and Son, cabinet makers, 36, Jamaica Street, Glasgow, who first directed his attention to the process about three years ago, and after testing and experimenting with it for about two years and a half, the results were so remarkably satisfactory and encouraging that he was induced to bring them under the notice of the Philosophical Society of Glasgow, in a paper read before it by James Deas, Esq., C.E., on the 11th of last April, when the inventor received the hearty commendation and thanks of the Society.

Messrs. A. Gardner and Son have employed the process extensively, and with every success, for the last three years, in connection with their large cabinet manufactory. In their regular course of business, table-tops made of mahogany treated by the process are jointed in from two to three weeks after being cut from the log, and the jointings of not even one of the many thousands of tops made per annum have been known to give way.

A three-feet square log of mahogany has been brought into their factory in its natural state, direct from the Clyde Trustees' timber yard at Yorkhill, been put through the seasoning process, been cut up into boards which were made into a counter top, all within three weeks.

In testing its preserving qualities, it was ascertained that pitwood employed in supporting some of the air passages of Messrs. Dixon and Co.'s No. 3 pit, in the south-eastern suburb of Glasgow, gave way with dry-rot, and had to be replaced within twelve months of being put in quite fresh; accordingly, several cartloads of Norway props, prepared by the Gardner process, were, at the end of September, 1875, put into the air passage where dry-rot most rapidly developed, alongside of unprepared ones from the same cargo, and on being examined in the beginning of October, 1876, the prepared timber was found to be as sound as the day it was put in, while the unprepared timber was completely destroyed.

An equally satisfactory result was obtained by the following test:—

On 2nd December, 1875, four sleepers of Baltic red wood, treated, two by dissolving the sap only, and the other two by adding the preservative chemicals, were laid down under the rails at the south end of the passenger shed, Queen Street station, North British Railway, Glasgow, where dry-rot has for years been extraordinarily active, completely destroying unpreserved sleepers in less than twelve months. On examining the four sleepers on the 2nd December, 1876, it was found that the red wood of the two which had only the sap dissolved was quite sound, but the surface of the blue wood showed signs of decay; while as regards the two which were chemically treated, both red and blue wood were equally and thoroughly preserved.

The process also strengthens and solidifies the timber. This has

been clearly proved by various severe tests. Two pieces of Scotch fir, cut from the top of the same tree and from each other, one prepared and the other unprepared, were crushed to destruction, the former by a load of 27 tons 10 cwt., while the latter succumbed to a load of 17 tons 10 cwt. In the same way, in the case of two pieces of pitch pine, the prepared stood 37 tons 10 cwt., the unprepared 22 tons 10 cwt.

With a view to substituting pitch pine for American white oak for carriage and waggon building, the North British Railway Company cut a piece of oak and a piece of pitch pine exactly the same size, viz., $3\frac{1}{2}$ inches long by $3\frac{7}{8}$ inches by $2\frac{7}{8}$ inches; the pitch pine was prepared, and both tested by being crushed to destruction at the company's works at Cowlairs. The prepared pitch pine gave way with a load of 90 tons, while the oak, in its natural state, gave way at 47 tons 10 cwt. White pine (spruce) was also tested by them: two pieces were cut from each other, and exactly the same size, viz., $3\frac{1}{8}$ inches long by $2\frac{5}{8}$ inches by $2\frac{1}{4}$ inches; the prepared one gave way at 35 tons load, the unprepared one at 25 tons.

The increased density of the prepared timber over the unprepared gives the former this valuable quality, that it expands and contracts much less under changes of temperature and of moisture than the latter.

The process further affords a ready means of impregnating timber with liquid chemicals, which, while preserving the wood from decay, will render it invulnerable to the destructive ravages of the *Teredos navalis, Limnoria*, the white ant of India, and all other worms and insects which prey upon timber; and by the kindness of Sir John Coode, C.E., an opportunity has been offered Mr. Gardner of putting this to practical tests, by exposing timber so preserved to the free attacks of the *Limnoria* at the Douglas Harbour Works, Isle of Man, and to the *Teredos* at the Pier Works, Gorlestone, near Yarmouth, and at Colombo, Ceylon.

The process is also of special advantage to the builders and owners of hothouses, as hitherto the only serious objection to the use of wood for hothouses has been its liability to rot and decay when exposed to the action of a hot, moist atmosphere, as in the case of stoves, pine-pits, forcing-houses, vineries, and, indeed, in all horticultural erections where a warm, moist temperature is requisite. It is quite impossible to get any timber, in its natural state, thoroughly proof against this tendency to rot and quick decay; hence the importance of the discovery of the Gardner Preserving Process as applied to hothouse building. It not only extracts the sap or decayable matter from the wood, and so seasons it thoroughly, but at the same time renders it proof against either damp or dry-rot. The expense of applying this valuable process does not amount to more than three per cent. on the entire cost of the building.

The eminent firm of James Boyd and Sons, horticultural builders and heating engineers, Paisley, have adopted the process in seasoning and preserving the wood they use in their extensive hothouse building operations throughout the country. For the performance of the process upon such a large quantity of timber as they require in their extensive business, Mr. Gardner has erected, at their works at Paisley, a large wooden tank or box, 50 feet long by 6 feet wide, and 6 feet deep, closed on the bottom, sides, and one end, the other end being moveable, so as to give easy access to the tank. A small iron pipe is led from a steam boiler in use at the works to the tank, and is continued by a copper pipe of about one inch in diameter, with holes pierced in it at short intervals, laid along the bottom of the tank from end to end, and which is protected by wooden spars from the timber which is laid over it to be preserved. The tank is then filled up with timber, laid solid—it may be either in the log, deals, battens, or plank, but not wrought timber. When full the tank is covered with planks, laid across it edge to edge closely, but not fastened down, the end being closed and the steam turned on at about 20 lbs. pressure, and this continues for forty-eight hours. After about twenty-four hours steam has been turned on, Mr. Gardner, who has been advised beforehand, sends one of his assistants, who introduces the chemicals through the steam pipe to the wood. The timber is thereby completely saturated with the chemical substance, even large logs being thoroughly penetrated to the core. The process does not discolour the wood, nor give any disagreeable smell to the timber. After being taken out of the tank it has to be either dried in a stove, or by exposure to the weather for a fortnight or so, when it is ready for use.

By subjecting it to a second chemical process, timber required for extreme cases can be rendered absolutely proof against decay by filling up the pores with chemicals. Mr. Gardner erects the tank at his own expense, and supplies and applies all the chemicals, which, of course, are known only to himself, Messrs. Boyd and Sons supplying the steam and paying a royalty, according to the size of the tank, on the cubic contents of the timber operated upon.

The process is now in use among Railway Engineers, Architects, Cabinet-makers, House Builders, Coal Masters, Farmers, and Estate Agents, &c., and is perfectly adaptable to all kinds of timber. It is quickly taking the place of creosote, because it is, unlike that substance, a perfect preservative of the wood to its core, and because it is quite cleanly and does not discolour the wood. The process has been patented in nearly all Continental countries, and arrangements are now being concluded in these countries for its introduction and use. It well deserves the careful consideration of all who are in any way interested in the seasoning of timber and rendering it as endurable as possible.

In New Zealand, a colony of comparatively recent origin, and in a natural state possessed of a large extent of splendid timber forest, it has of late begun to be felt that the indiscriminate clearing of the forest land by the settlers was tending to the deterioration and uncertainty of the climate and water supply, and considerably affecting the price and supply of timber for constructive purposes in the neighbourhood of the larger towns and in the earlier settled districts, and fears were freely expressed by those who were best able to judge, that if such a state of matters were allowed to go on much longer it would quickly ruin the hitherto wonderful prosperity of this young and enterprising colony. The Colonial Government, with a wisdom and foresight that might be profitably followed nearer home, at once took the matter in hand, and under the able direction of the late Premier of the Colonial Parliament, Sir Julius Vogel, immediately set about devising means for efficiently grappling with the difficulty. With that object in view they applied for advice and assistance wherever the best of either could be found; and through the courtesy of the Indian Government they were able to secure the valuable services of Captain Campbell Walker, of the Indian Forest Department, a gentleman of wide experience, and thoroughly versed in all branches of forestry, and under whose direction the forests of the colony are certain to be put upon a proper system of management, and in the course of a few years become a prolific source of revenue to the colonial exchequer.

It is little more than a year ago since Captain C. Walker arrived in the colony, and his plans for the future conservation of the forests can hardly yet be fully matured, but we see by our New Zealand exchanges that he is doing excellent preliminary work in inspecting the existing forests, surveying districts likely to require afforestment, and by reports and lectures enlightening the people upon the nature of State Forestry, and the extent to which it can be adopted and profitably carried out in the colony. In speaking of the system of management which he proposes for the existing forests, he says, "That I have formed a high opinion of the New Zealand forests, and I think, if the public will permit us, we shall make a very valuable property of what we reserve, and secure a fair and steadily increasing revenue from what we dispose of. It has been argued by some that the £10,000 per annum appropriated under the existing 'State Forest Act' is inadequate for planting purposes, and that as the colony cannot afford to supplement it, or even to spend that sum, the whole thing had better be dropped. Now I am very glad to have the £10,000 appropriated for the first few years as a reserve fund to draw upon, but I do not intend to trench much upon it, and any scheme I may bring forward will be based on the principle that the forest department should be

entirely self-supporting, the revenues derived from existing indigenous forests in the lands of the Crown being made sufficient to cover all expenditure for establishments and working, gradual formation of plantations, &c., &c., the surplus, after defraying all the above charges, being Colonial Forest Revenue. I wish especially to guard myself against forming or expressing Utopian or too rosy views on this subject, and I do not pretend that we are going to clothe barren hillsides and desert plains with trees in a year, or even in several years, or that the indigenous forests are at once to pay off the colonial debt; but I do say that with proper management we should be able to plant wherever necessary, secure a permanent and improved supply of timber for the use of individuals and public departments, and retain an intact and gradually improving forest property, whose capital value *may* represent the colonial debt, and the income derived from which *ought* to go *far* towards meeting the interest thereon . . . My duty at present is to submit a report on my inspection of the New Zealand forests, with proposals for their management and conservation. These proposals, so far as I have given them shape in my own mind, will consist in—1. The absolute reservation of a comparatively small proportion of the unalienated forest area. 2. The gradual disposal of the timber and forest products on the remainder of the waste forest lands to the best advantage. 3. The formation of Government plantations wherever we can do so without financial loss, or it is proved they are absolutely essential to the public good. 4. The encouragement of planting by private proprietors, by giving them liberal grants of land in lieu of whatever area they plant." Such a scheme of forest conservancy cannot fail to be successful, and ultimately highly remunerative to the colony, if Captain Walker receives the encouragement and support necessary to put it into shape and give it a fair start. From the prompt and energetic way in which the matter has been carried out so far, we look forward with confidence to seeing it successfully completed, and a model system of State Forestry established by our brethren at the antipodes.

Cultural First Principles.

By G. S. BOULGER, F.L.S., F.G.S., late Professor of Natural History in the Agricultural College, Cirencester.

IV. Plant-Cells.

(*Continued from page* 463.)

Having discussed the conditions of climate and soil under which we are to plant, we come to the third and most complex and variable condition of which arboriculture is a function, the nature, life, or physiology of the trees themselves. In laying down first principles it is not my object to discuss the individual appearance or botanical characters which are peculiar to each species of forest tree, but I am about to write of those general laws of structure, nutrition, and reproduction which it is necessary for every cultivator to know, and which are true alike of the wheat plant or the oak, of the beech or of grass, of the turnip or of the fir tree. I know no book in which these laws are more simple or more accurately explained than in Professor Johnson's "How Crops Grow," edited by Professors Church and Dyer, a work unfortunately out of print.

The two principal functions of every organism are its own nutrition and the reproduction of its species; but before we can understand these vital processes, which constitute the main physiology of the plant, we must be acquainted with their ultimate or minute anatomy or structure.

Plants are built up of cells. Some of the lowest plants, such as that blue mould with which we are all familiar, or brewer's yeast, which is a plant growing in alcoholic liquids, may consist of single cells, and in the pulp of an orange, a boiled mealy potato, or a pod of the cotton plant, we may isolate the separate cells of complex structures. We find that the vegetable cell consists essentially of a continuous membranous coat, without perforations, which in its young state is entirely filled with a yellowish, mucilaginous, semi-fluid, albuminoid substance known as protoplasm. The membrane, or cell-wall, consists of the carbohydrate cellulose ($C_6H_{10}O_5$); the protoplasm is a highly complex substance, containing nitrogen in addition to the constituent elements of cellulose, with a small proportion of sulphur, and also, probably invariably, phosphorus. As the cell grows the protoplasm becomes almost entirely thrust on one side by a more transparent and

liquid substance, the cell-sap. Cells seldom, however, occur in their elementary spherical form. More generally they are more or less compressed and adhere together in what are known as vegetable tissues.

Of the vegetable tissues, the most important to the forester is undoubtedly wood, which owes its importance to the length of its constituent cells, their intertwining, and their hardness from the substances deposited on their interiors.

The cells in wood are mostly elongated, tapering at each end, and adhering by their sides. As they grow older cells often, especially in wood, deposit cellulose, and another carbohydrate, known as *lignine*, on the inside of their cell walls, and great changes occur in the contents of the cell, for the cell-wall is readily permeable to liquids. Cells vary in size, the spores of some fungi being less than $\frac{1}{1200}$ of an inch in diameter, while in the pulp of a lemon many cells are more than half an inch long, and the hairs on the seeds of a shrub known as Gossypium, which are familiar to us as cotton, are single cells often two inches long.

Plants take in liquid and gaseous food through their cell-walls, and the protoplasm of growing cells is capable of dividing and secreting a partition of cellulose, so as to form two cells, or even four, out of one.

The growth of a plant is then nothing more than the aggregate result of the enlargement and multiplication by cell division of the cells which compose it.

Some vegetable cells grow and multiply with astonishing rapidity. Thus a puff-ball has grown to a foot in diameter in a single night; this representing the production perhaps of three or four hundred million cells per hour, though it may have been partly due to the enlargement of previously formed cells.

In the centre or heartwood of timber trees the cells are physiologically dead, the vital fluids having ceased to circulate in them, owing to their being blocked up by the formation of *lignine*. This is what renders this dead tissue valuable as timber. Again, in the bark of trees there are cells containing nothing but air. Of such cells is cork composed—the bark of *Quercus suber*—and from this contained air it derives its utility.

Attention to some simple principles such as these might save many a misconception, such, for instance, as the statement which circulated from America, through many of our "scientific" papers, that diatoms had been found in the cells of wheat-straw. The various kinds of tissues are of importance to the botanist, but the forester need not carry his studies into such detail, but may at once go on to learn how the tissues build up the different organs of the plant.

On Planting.

By ALFRED J. BURROWS, Pluckley, Kent.

(*Continued from page* 470.)

Having in a previous paper taken a general view of planting, it is now proposed to enter more particularly into the various details of the operation, premising that of all the forester's occupations this is the one which requires the greatest care and the most assiduous supervision. Izaak Walton's advice to followers of the piscatorial art is equally applicable to the planter, who in dealing with his trees should "handle them as though he loved them." Undue haste or carelessness is certain to produce disappointment.

To insure successful planting a good home nursery is indispensable; or at any rate there must be what has appropriately been called a "second-hand nursery," into which has been transplanted a supply of good nursery seedlings. In sending out orders the nurseryman himself selects what is really the planter's weather; and when the journey is a long one there is great risk of the goods arriving at a time when they cannot be immediately planted out. Add to this the risks of long exposure, of overheating from close packing, the effects of frosts and cold easterly winds, and the injury from being long bedded in, and the chances of putting in really healthy plants are small indeed.

Holing and trenching may be executed by contract, but raising, pruning, and planting should be done by day work. Where the holes are prepared and the plants have been undercut *in situ* the previous autumn or spring, no spade will be required except for filling in the soil, or for notching where the latter system is adopted.

The planter's tools are simple, but they should all be of good quality, and not too heavy. They consist of—

1. A small three-pronged fork for raising seedlings and other small plants: this should be short in the handle, and light enough to be used by one hand.

2. A common three or four pronged fork of full size, and with a crutched handle of average length, for opening out the plants for removal.

3. A good cutting and half worn-out spade for notching in the smaller plants and filling in soil and compost.

4. A diamond dibble, somewhat pointed at the end, and strong in

the neck and handle, for opening up the notched ground for the reception of the seedlings.

5. A combined pick and mattock for holing in very hard and stony ground, where the holes are made as the planting proceeds.

6. A two or three pronged short-handled hoe, resembling the "Canterbury hoe," for the removal of stones after the soil has been well loosened by the mattock.

7. A small one-handed adze-like planting hoe, about 4½ or 5 inches wide at the extremity of the blade, for holing for small plants in the loosened ground.

All things being prepared, the forester will choose his weather, and divide his available staff into raisers, pruners, carriers, and planters, in numbers proportioned to the requirements of the several operations. The raisers will commence by opening a trench alongside the first row of trees to be raised, and a little deeper than the roots penetrate, and so completely loosen the soil that the plants will come out without force and with their roots intact. This operation must be repeated for every succeeding row until all are raised. By proceeding with great care very little root-pruning will be necessary. But where the tap-roots have not been previously undercut they should now be shortened, and any injured roots should be removed. Immediately this is done immerse the roots and a few inches of the stem in a puddle of clay and water of such a consistency that it will stick well to them. Whoever has paid much attention to the structure and functions of roots, and has observed that it is through the spongioles at the ends of the slender fibres—and through these alone—that the plant obtains its nourishment from the soil, will hesitate before cutting back a single root. The larger roots are covered with an epidermis, or skin, which in older trees becomes thickened into a cortical integument, like bark, and are quite destitute of pores.

Though root-pruning is a custom "more honoured in the breach than the observance," yet it will often be necessary to prune back the head of a plant so as to start it on its course with a fair chance of success. This will be desirable when from injury or otherwise its root-growth is greatly disproportioned to the size of the head. To replant it in this state would be to start it on its course too heavily handicapped, and sooner or later it must succumb. By a judicious lightening of the head, and thus adapting its requirements to the power of the roots, the equilibrium may be restored, and such shoots only will be produced as the roots have power to support. The neglect of this precaution is the reason why in a new plantation so many of the trees shoot only from near the ground or break out in sprigs a little way up. But such pruning as is here recommended requires great care and judgment, and should only be entrusted to

experienced hands. Besides, as it can only be practised in the case of deciduous trees, it ought to ensure all the more care being taken in raising the coniferous kinds.

During their removal all plants should have their roots carefully covered, and where bedding in has to be resorted to, choose moderately dry and warm ground. In the case of Scotch and spruce firs, and other persistent-leaved kinds, spread them out thinly in the lines, or mouldiness will follow. The roots should in all cases be embedded in tolerably fine soil.

Where the plants are small and the system of notching-in is practised, the marker goes forward, and by a cross-cut of his spade indicates the position of each plant. The planter who follows strikes the point of his spade or diamond-dibble into the ground at one extremity of the cross, and to a depth proportioned to the requirements of his plant, and then depresses the handle, upon which the grounds open at the centre of the notch, wide enough to allow the boy or carrier to insert the plant. By withdrawing the spade after adjusting the roots the ground closes, and a slight pressure of the foot completes the operation. In this way a man and boy may plant from 1,200 to 1,500 trees per day. Where small plants are used, and the land is of a nature to require the use of the planting mattock, the ground is well loosened, and the larger stones removed from the hole, after which the operation is completed with the aid of the planting hoe, a light treading being necessary to finish it.

In planting-in prepared holes water should be let off, and the bottom should be well stirred and loosened. The addition of compost, a little lime, or some burnt soil, will prove invaluable. In making such additions the object should be to meet the requirements of the intended crop, and cause the new position to assimilate as much as possible to the old one. Where the turf is not to be replaced around the stem, it is better to chop it finely and put it in the bottom of the hole, as it seldom settles firmly above the roots. While the tree is held by a boy in an upright position, the planter shakes over its roots some of the finest soil within his reach, and by gently moving it up and down every crevice is filled. At the same time care should be taken to feather out the roots by hand, to distribute them evenly throughout the whole soil, and put them in their natural positions. This system will place them under the most favourable circumstances for obtaining their regular supply of food, and will be most likely to ensure permanent stability.

No treading should be allowed except upon very light soils, and even there the operation is better deferred till some days after planting. To stamp heavily upon wet earth or clay immediately it is placed around the roots of trees, is to encase them in an almost im-

penetrable mass of soil, from which their tender fibres can derive little or no nourishment.

In situations of great exposure it is a common practice to place the tree in one corner of the dug hole, giving it the support of the unmoved ground on its leeward side. But as in such a case the roots must all be spread out on the opposite side, and will consequently make their most vigorous growth in that direction, while they will be very slow in penetrating the firm soil, the practice is not to be recommended. In the well-trenched nursery grounds it may be advisable; but where upon very firm soils holing alone has been the preparation, its advantages are very questionable.

Upon light and stony soils the stones are sometimes placed around or near the stem of the plant, to counteract the loosening effects of frosts. It is necessary at all times to prevent rocking, as no satisfactory root-growth can be made while this continues. Hence the disadvantage of using plants which have stood very close together in the nursery lines. Their growth is not sufficiently robust to fit them for exposed places.

In conclusion, we cannot too strongly insist upon the necessity of a proper preparation of the ground, a judicious selection of trees, and of weather for removing them, and careful handling in every operation. By a strict attention to this the planter may rest satisfied that, though "'tis not in mortals to *command success*," he'll "*deserve it.*"

Silver Fir for Railway Sleepers, &c.

By WILLIAM McCORQUODALE, Forester and Wood Surveyor,
Scone Palace, Perth.

It may be interesting to some of the readers of the Journal to know and look forward to the ultimate result of an experiment I have been recently making to test the durability of silver fir sleepers.

For many years I have been making searching inquiries of railway officials and others relative to the durability of silver fir as railway sleepers, but have hitherto failed to obtain any information of the slightest value on the subject.

I therefore resolved, as a last resource, to carry out an experiment which will prove out in a few years an assured test as to the value of common silver fir (*Picea pectinata*) for railway sleepers.

With the approval of my noble employer, the Earl of Mansfield, I got four ten-inch sleepers cut out in April, 1876, from a tree seventy years of age, and these were at once set out for seasoning in the open air, where they were allowed to remain for twelve months. In the spring of 1877, I applied to Thomas Winning, Esq., C.E., Forfar, inspector over the Perth and Aberdeen section of the Caledonian Railway, asking his permission and assistance to have them laid into the line at a point convenient for me to look after them.

Mr. Winning, in the most complacent manner, replied, "I shall be happy to afford you every facility in my power to enable you to arrive at the information you desiderate."

The Perth District Inspector, Mr. Fraser, had men then engaged lifting the old sleepers and relaying new foreign ones, near Luncarty station, about four miles north of Perth; and on the 17th day of April, 1877, I saw the four silver fir sleepers laid into the line alongside the foreign ones. The silver ones are conspicuously marked for inspection, and they shall be carefully looked after and fairly tested.

As gate and common wire fence-posts I consider silver fir the most durable of all our commonly grown firs, larch excepted.

In making inspection of woods and plantations over a great part of Scotland I find that silver fir, at all stages of its growth above forty years of age, invariably surpasses all other firs in size, and from taking cognizance of its rapid growth for many years, I am satisfied that it is a tree which ought to be largely introduced into our woodlands.

On dry sandy soils, where larch and spruce are frequently affected with dry rot, silver fir will grow to large dimensions, and remain entirely free from rot.

The largest silver firs in Scotland, perhaps in Great Britain, are the two on his Grace the Duke of Argyle's property at Roseneath. Upwards of fifty years ago a brother of mine assisted Mr. Monteith to measure the two for insertion in his book entitled "The Forester's Guide." Each of these trees contained at that time upwards of 500 cubic feet of timber. I saw them a few years ago, when they appeared quite healthy, and are still growing in bulk. On the estate of Lynedoch here there is a very fine specimen, measuring upwards of 330 cubic feet.

Abercairny and Braco estates, in Perthshire, were famous for silver firs at one period; and there are fine specimens still growing at Dupplin, also on Hopetoun, Arniston, Penicuik, and other estates in Scotland.

To show my own appreciation of the silver fir, I may say that I have recommended it for years to be planted extensively on many estates. Last year I laid out twenty-two sites, varying in area from 100 to 500 acres, for new plantations upon one estate in Forfarshire; and where I considered the soil particularly suitable, I recommended silver fir to be planted for the permanent crop, with larch only as nurses.

Important Sale of Trees and Shrubs.

An extensive sale by public auction of hardy evergreen trees and shrubs, the property of the Lawson Seed and Nursery Company, Limited, was held at the Nurseries, Inverleith Row, Edinburgh, on Nov. 7th and 8th. The stock, which was sold in consequence of proposed building operations necessitating the clearing part of the nursery grounds, comprised fine specimen and other sizes of *Araucarias*, *Cedrus deodara*, *Cedrus Atlantica*, *Cupressus Lawsoniana*, *Picea nobilis*, besides a large assortment of ornamental plants of other descriptions, also hothouse and greenhouse plants. The sale, which was conveniently held on the two days following the meeting of the Scottish Arboricultural Society, attracted a large and influential gathering of nurserymen and other buyers from various parts of the country, many of whom were doubtless tempted by the conveniently small lots into which the stock was divided. The interest was well maintained throughout the sale, and while the competition for certain lots was very keen, the general average of prices appeared decidedly high, and of a nature satisfactory to the vendors. The auctioneer, Mr. Lyon, of the firm of Lyon and Turnbull, got through the 1641 lots with commendable expedition, and aided by exceptionally fine weather, the sale on both days must be regarded as highly successful.

The Timber Trees of the Future.

By D. F. McKENZIE, Forester, Murthley Castle, Perthshire.

We may venture to guess that *Abies Douglasii* will sooner or later take the place of our larch, and *Abies Menziesii* that of our other pines. The timber of *A. Douglasii* is as durable as larch, when in contact with the soil as a fence or other post or stob, it being in most cases equally full of resin. It is also much prettier for decorative work and house carpentry. Roofs on the Gothic principle, such as the famous roof over Westminster Hall, London, if done with the wood of the Douglas fir, could not for beauty be excelled even by the best oak, as it has naturally a rich mellow colour when of large dimensions. It also lacks the bad qualities of the larch, as it does not *twist* or warp, and is not, so far as has yet been ascertained, liable to any disease in this country, while it produces nearly double the bulk of timber in a given time.

Abies Menziesii is also a rapid growing timber tree of large dimensions, and though described as only growing from "50 to 70 feet high" [70 to 80 feet, Gordon; 80 to 100 feet, Hort.—*Ed.*] in its native habitat, yet it is already about these heights in this country, although comparatively a young tree, while the proportions of the trunk, and the general appearance of the tree, bid fair to double the above-stated altitude at no distant period. On account of its knotty quality it would, like *A. Douglasii*, be useful for house carpentry, and any woodwork to be varnished; but this same quality prevents it from being used for beams, or where any great strength is desirable, as knotty wood is not strong, but if grown close in masses it would be more suitable, as, generally speaking, its fibre is more elastic and tenacious than fir or Norway spruce. Neither does it rot so readily as Norway spruce when in contact with the soil, but I have had no experience of its qualities when in continual contact with water.

The figures given below will supply intending planters with data to judge for themselves whether or not it is more profitable to plant *Abies Douglasii* and *A. Menziesii* than larch, Scots, or spruce fir, admitting that the first cost is considerably greater. What is wanted now-a-days is a tree that will grow quickly into useful timber, to supply the rapidly increasing demand.

To plant an acre of *Abies Douglasii*, 10 feet apart, with plants 18 to

24 inches high, and with larch of the same height to 5 feet over all, £7 10s., or thereby, including labour, &c. *Abies Menziesii* would cost about the same figure; a large sum, no doubt, but then the returns would much exceed the ordinary returns from an *average* acre of timber.

To thin out the crop of *larch* to *one-fourth* of the whole at 15 to 20 years old, allowing for casualties under ordinary circumstances, would give, after paying for felling, &c., £30 to £40. The remainder, cut out at 35 years old, would give about the same sum of clear revenue. At 75 years old the principal crop would be valued for £500 to £600 under ordinary conditions. The returns of an acre of *Abies Menziesii* would be considerably less, at least £100, as the timber, although of the same bulk, would not be so valuable. On comparing the above figures with the ordinary run of timber sold in Scotland, there will be found a considerable balance in favour of the planting of the newer varieties. My data are taken from a careful measurement of the different trees—which I give below—compared with common trees growing within a few yards of those mentioned.

Abers Douglasii: 27 to 33 years old, 45 to 60 feet high; circumference at 2 feet from the ground, 6½ to 8½ feet; spread of branches, 20 to 70 feet; soil, light sandy loam of an average quality, resting on deep gravel, and in some places a damp marshy soil. In many places the soil is remarkably dry, yet the growth of the tree is vigorous, and the foliage of a dark green, resembling, at a short distance from the tree, the common yew. The situation is moderately exposed, in some instances freely, and the trees have a slight lean or lurch to the east, resembling the larch in this particular. Height above sea level, 200 to 300 feet.

Abies Menziesii: grown on the same description of soil, and under similar circumstances; 25 to 30 years old, 45 to 55 feet high, 5 to 8½ feet circumference at 2 feet from the ground; spread of branches, 24 feet. In dry soil it grows vigorously, but is in some instances affected with red spider: this only occurs on *very* poor soils, and in exposed situations.

Compare now the growth of larch, Scots fir, and Norway spruce growing alongside of those just mentioned.

Larch: 25 to 30 years old, 30 to 40 feet high; circumference 2 feet from ground, 2 feet 4 inches.

Scots fir: same age, 20 to 30 feet high, 2 feet to 2 feet 6 inches in girth at 2 feet from the ground.

Norway spruce: 30 to 35 years old, 30 to 40 feet high; 3½ to 4 feet circumference at 2 feet from the ground.

There is undoubtedly a great difference here in the bulk of the timber produced, much more than would repay the difference of price in planting an acre.

On the same soil, and in the same exposure, there are other trees worthy of notice:—*Pinus monticola*, 27 years old, 45 feet high, 3 feet 2 inches to 4 feet 4 inches circumference of stem, and straight as an arrow. The branches for three-fourths of the height of this tree are quite horizontal, and though grown in an open space are equally branched all round, and spread at most only 12 feet.

Wellingtonia gigantea, 28 years old, 40 feet high or thereby, 7 feet 1 inch circumference; spread of branches about 10 feet.

Taxodium Sempervirens (Sequoia), 20 to 30 years old, as many feet high, and from 3½ to 7 feet in circumference.

Hundreds of *Deodaras, Araucarias, Cryptomerias*, and *Picea nobilis*, the common and glaucous varieties, thrive equally well on the same kind of soil, though the latter, as well as *Picea pinsapo* produce larger timber, and are more healthy in appearance when grown on a cool, moist soil.

Large and Remarkable Trees.

At Williamstone, in the parish of Madderty, Perthshire, we measured the other day a fine old walnut tree, the only one now remaining of several grand old trees of the same kind which grew there some years ago, and I found it to be of the following dimensions, viz., the circumference of the stem at a foot from the base is 13 feet 9 inches; height of the stem from the base to the first branches, 17 feet; girth of stem immediately below the spring of the branches, 8 feet 3 inches; and the circumference of the spread of the branches about 150 feet. There is a large quantity of measurable timber in the principal branches, one of which girths 7 feet about three feet above the fork, and another 6 feet at the same distance up, but owing to want of means of access I was unable to take correct measurements of the limbs.

The other walnut trees which formerly grew here have either been cut down or destroyed by storms, so that not a vestige of them now remains; but if my memory is correct, some of them were even grander old trees than the above fine specimen, which I hope will long remain in its present healthy state an interesting and picturesque object in the landscape.

Near by this fine "walnut" stands a venerable oak, a veritable "monarch of the forest," the circumference of the stem at a foot from the ground being 20 feet 6 inches, and the height of the trunk up to the spring of the branches 15 feet, the girth at that height being 15 feet; after which the trunk breaks up into four splendid limbs, forming a rich umbrageus canopy of healthy leaves and branches. J. D. M.

The Degeneracy of Scotch Fir.

THERE is something exceedingly pleasing in the prospect of a richly wooded landscape. The eye rests with delight upon the scene. Spring, summer, and autumn seem to vie with each other in clothing our plantations with beauty; while winter, the night of nature, cannot rob them of their charms. Thus at all seasons they are not only pleasant to look upon, but excite agreeable and elevating sentiments.

To the man of taste and refinement, then, the cultivation of forest trees must ever be an object of deep and lively interest; but when we add to this their paramount importance as an essential element in the vast fabric of industrial life, not to mention their usefulness and beauty in the way of shelter and ornament, how vastly is their value enhanced It is, therefore, a question of importance, and one that may well occupy our best attention, what class of trees is most likely to meet the two-fold requirements of ornamentation and utility? While I hardly feel sanguine enough that any remarks of mine will have much weight, or be able to throw much light on this subject, still I believe that the problem may ultimately be solved after years of patient and well-directed observation, and the collecting of facts from a wide range of experience; and every one who adds the accumulated fruit of his observations to the cairn of ascertained facts aids so far the solution of the question.

The degeneracy and diversity of our Scotch fir being a subject in which I have taken a deep interest, and to which I have paid considerable attention, I now desire to submit a short statement of my experience, and the conclusions at which I have arrived respecting some of the varieties, in the hope that it may stimulate others to record their observations and experience in this important branch of arboriculture. The necessity of taking some step in this direction has been forced on my mind by seeing the unprofitable, and in many cases unsightly, state of the Scotch fir plantations throughout the country.

A circumstance came under my notice lately which convinced me more than ever of the superiority of the *true native* over the spurious Scotch fir, and the characteristics peculiar to both, as well as those of a foreign origin.

In thinning a plantation about thirty years old, where some of the real old Braemar Scots fir had been allowed to remain from a former crop, and from which seed had fallen and grown up, along with plants

got from the nurseries, the difference both in quality and appearance was very marked. The "native" seedlings were much harder to cut, richer in quality, more compact and beautiful in appearance, the branches being smaller and more horizontal, and the foliage of a darker green, while the leading buds are a much brighter red, and the bark is clearer and redder in colour than either the spurious or foreign varieties. In the neighbourhood of this plantation there is another, in which the Scotch firs are of the very coarsest description, and not worth growing (though got from a respectable firm for the *true* native), and when compared with the seedlings in the former case the difference is more marked still. Instead of the compact-headed, rich-foliaged Braemar variety, they are a coarse, long, straggling-branched fir of a very different type, the most distinguishing feature in this case being that the seedlings are shorter in foliage and more glaucous in colour. There is yet another variety of fir, which I take to be foreign, and is distinguished by its strong and coarse habit of growth, the foliage of which is longer, and inclined to twist like that of *Pinus laricio*. There are many other instances which might be quoted in the same direction, but enough at present.

The cause of this degeneracy, &c., may be variously accounted for; for example, by gathering seed from stunted, unhealthy, and deserted trees, and by the introduction of foreign seed, the produce of which has got so mixed up with that of home origin that it is difficult to distinguish the true variety from the spurious in the young state; and I fear we shall have more and more of the foreign element introduced into this country, seeing that the vast native Scots fir forests are being ruthlessly cut down, which, if much longer persevered in, will soon render true native seed a scarce commodity, and increase the demand for seed from abroad when Scots fir will be found to have lost its real character and worth. Let us hope, however, that all concerned will do what they can to propagate and increase the produce of the true native variety of Scots fir, *Pinus sylvestris.*

An Observer.

School of Forestry at Evois, in Finland.

By the Rev. J. C. BROWN, LL.D.

In 1858, Baron von Berg, Oberforst-rath in Saxony, the birthplace of modern scientific forest management, was applied to professionally to examine and report on the state of the forests and the forest management of Finland; and while there he has applied to do the same in Poland.

One result of his visit was the establishment at Nova Alexandra, in Poland, of an important School of Agriculture, ranking with the universities of the empire. It was founded with a view to prepare agriculturists and foresters for carrying on their respective operations in accordance with the discoveries of modern science. There are two divisions, one relating to agriculture, the other to forest economy. There is an experimental form attached to the institution, and the course of study extending over three years. Students previous to admission must have passed through a gymnasium or some corresponding public school. The fee charged is 50 roubles, say six guineas, per annum, and after passing satisfactorily a prescribed examination at the close of the course, the students receive a diploma giving them rank and title to employment by the Government as agriculturists or as foresters, according to the division in which they may have studied.

A corresponding result was the establishment of a School of Forestry at the Crown Park of Evois in Lampes-socken, in Tavastehuslän in Finland, with a view to giving to foresters thorough instruction in all that relates to the theory and practice of forest economy. It was established by Decree dated 10th March, 1859, and opened on the 15th of April in the same year, thoroughly organized, and placed under the superintendence and charge of a director, with three resident lecturers and one field instructor. Students desirous of enjoying the benefit of the institution were required to produce before admission a university diploma, or a first-class certificate of the completion of the course of study at a gymnasium. And there was provided for them free instruction, with free quarters and firewood.

After a time the institution was closed from lack of students; but

in 1874 it was reorganized by a Decree dated May 2, 1874, of which the following is a translation; and the subjoined rules were laid down by the same high authority :—

"*Helsingfors, May 2nd*, 1874.—We, Alexander II., &c., &c., make known that since the Economic Department of the senate for Finland have come to us with an humble representation as to the reconstruction of Evois Forest Institute, in a manner suitable to the demands of the present time, and with this view have proposed that the instruction in the institute for the future, while retaining its fundamental plan, should nevertheless be so arranged as to take principally a practical direction; We, in harmony with this, confirmed by what the Governor-general has found to be good on the subject, while abolishing the Decree of the 15th April, 1859, concerning the organization of the institute, lay down the following directions for the future action of the said institute :—

"1. The Forest Institute, together with the Crown Parks of Evois and Wesijako thereto belonging, shall be placed under the strict superintendence of a director, who shall likewise participate in communicating instruction, and who shall conduct the practical exercises of the pupils in the field; besides him a teacher shall be installed in the institution, who shall aid the Forest-master for the said Crown Parks in the practical instruction of the students.

"2. The director and teacher shall be entitled to a pension for themselves, their widows and children, according to the rules laid down for the Civil Service. While the director shall be nominated by Us on the mention of the Economic Department of the senate, the teacher is to be nominated by the said department of the senate as soon as the service in the prescribed order renders it necessary.

"3. Exclusively of the higher scientific ends for which instruction is communicated, for the future instruction shall be given in forest science, geology, the science of engineering, agriculture, forest law, map drawing, and linear drawing.

"4. The number of the ordinary pupils, the extent of the curriculum, the division of the subjects of instruction amongst the teachers, the course of lessons, and the proper hours, shall be, on the representation of the forest administration, determined by the senate.

"5. As a condition for reception into the institute, there is required a certificate of good character and Christian knowledge, and either a student's certificate from the Alexander University, or a full certificate of dismission with approval from some one of the public or private schools of the country. Pupils, on the ground of such certificate, have to record themselves prepared to undergo the student's examination, and prove then that they possess a well-grounded acquaintance with the mathematical sciences, together with the knowledge prescribed for land measurers and forest masters, or they must produce other well-authenticated evidence of their well-grounded knowledge in the last-mentioned branches of science.

"6. Every pupil shall at the time of his inscription pay into the institute 40 marks; but he shall receive for this free instruction, lodging, and heating.

"7. The institute shall consist of two classes, so arranged that a complete course shall be gone through in two years.

"8. A pupil may not remain in the institution longer than four years. The lectureships held by the three ordinary lecturers who have hitherto been employed in the institute, and whose office has been abolished by this decree, shall not be continued after the decease of the present

holders; but these are nevertheless bound until they obtain another situation, or go in any other way out of service, to communicate instruction, each in his own branch, to the pupils of the institution who present themselves for this end, with the approval of the director, to obtain the said instruction along with the above-mentioned practical course. In connection with this We have, upon the said representation of the senate, chosen to allow that the highest three of the forest conductors who have gone through Evois Forest Institute, and by preference those who have distinguished themselves, shall receive till further notice a yearly payment of 800 marks, which payment, coming from the Finnish public chest, each of these forest conductors shall enjoy for a period of three years, so long as there is no demand for ordinary service, with the obligation to be at the disposition of the forest administration, instead of the hitherto regulation payment of four marks a day, it being provided that the senate at the proper time, when the number of the forest conductors or other circumstances make it possible to reduce these payments, may bring the matter again before us.

"Finally, We have left it to the economic department of the senate, in regard to the said ordered reconstitution of Evois Institute, to take order for the complete carrying out of these rules.

"*Helsingfors, May 2nd*, 1874.—According to his Imperial Majesty's own determination, and in his high name, the executive senate for Finland. (Sd.) R. Furnhielm, H. Molander, A. Mechelin, T. H. Thilen, Oscar Norrman, F. Walmquist.

"Rules laid down by his Imperial Majesty for Evois Forest Institute, given in Helsingfors, May 2nd, 1874:—

"We, Alexander II., &c., make known in accordance with the special decree already issued, that Evois Forest Institute shall for the future obtain an altered organization, and we have found good to lay down the following rules for the action and management of the institution.

"Chapter I.—The object and management of the institution.

"Section 1.—The institute has for its purpose to communicate theoretical and practical instruction in all that belongs to forest science to those who wish to devote themselves to forestry, and to obtain the necessary education and training for this.

"Section 2.—As experimental ground for the exercise of the practical work of forestry, there are appropriated Evois and Wesijako Crown Parks in Tavastehuslän, and the school erected on this last through the care of the institute, besides which the necessary botanical gardens, together with the plantation of native and foreign trees, shall be created and maintained.

"Section 3.—The institute shall be placed under the direction of a forest bureau, whose duty it shall be to follow with attention the action of the institution, and to arrange and conduct its business in conformity with these rules, and the further prescriptions which may with this view be communicated by the Imperial Senate.

"Section 4.—The forest bureau shall inspect yearly the teaching of the institution, and in conformity with this shall report the result to the imperial senate; and after the present regulations shall have been altered, they shall send a plan or programme of the study proposed, exhibiting the duration of the course of lectures, and the division of the subjects and hours of instruction amongst the teachers.

"Section 5.—It belongs to the director of the institute to watch over its

business, to see that the plan of the instruction is carried out, to control its management, and together with the teaching body to exercise discipline, and to carry out the arrangements as to the teaching and pupils, to engage and to discharge the servants of the institution, to fulfil the duty of head forest master in the parks of the institution, and to participate in imparting the instruction given.

"Chapter II.—The teachers.

"Section 6.—It belongs to the ordinary teacher in the institute, besides carrying out the instruction in the subjects according to section 24, to exercise the function of secretary and librarian; and besides attending to the management of the cash in the institute for Evois and Wesijako Crown parks, he must keep the accounts of the institution.

"Section 7.—The forest master for Evois and Wesijako Crown parks is bound in return for receipt of the appointed sum laid down in the arrangements of the institution, to communicate instruction in the institution in the branches of knowledge mentioned in section 24, and together with the others, to initiate the pupils in the purely practical work of forest master. Further, the forest master has on demand, and on receipt of prescribed payment, to communicate to the foresters of landed proprietors instruction in forest management.

"Section 8.—Those seeking the office of teacher in the institution must have a general humanistic culture, and must have gone through a complete course in a Finnish or well-known foreign forest institution, and must possess moreover appropriate skill in the subjects taught by him. When the office of teacher is sought by a person whose practical skill cannot be otherwise confirmed, he may, if it be judged necessary, be appointed provisionally for a trial period of at least two years, during which he shall have the benefit of all the privileges of the office, and thereafter if his services be found satisfactory he may be confirmed in the office.

"Section 9.—The director shall be named and removed by Us on the mention of the imperial senate, but the teacher shall be appointed by the senate according to the manner already prescribed.

"Section 10.—The director and the teacher shall be sworn into office before the chief director of the forest bureau.

"Section 11.—In the absence of the director, or if he is otherwise prevented from fulfilling his duties, the forest master shall represent him in the duties of his office. In case of interruption of the duties of the teacher or forest master for a short time by illness or otherwise the director is bound so to act that the pupils may be in some way properly employed. But if the interruption continues more than fourteen days, it is to be reported to the forest bureau, in order that proper arrangements may be made.

"Section 12.—Director and teacher are entitled to similar pensions for themselves, their wives and children, as other officials of the same standing.

"Chapter III.—The pupils.

"Section 13.—Those who wish to enter the institute as pupils have, after the official notice of the vacant places in the institute has appeared in Finland's Allmanna Tidning, to lodge before the 1st July with the director, a written request accompanied by the following documents:—

"A. A certificate of moral character from their minister.

"B. A medical certificate as to their bodily constitution and their vaccination.

"C. A student's certificate from the Alexander University, or a complete certificate of dismission from any of the country's public or private schools. Such pupils at these as have finished their course are entitled to enter themselves for the students' examination at the university on the ground of said certifi-

cate, and their possessing a good knowledge of the mathemathical sciences, together with a sufficient acquaintance with land measuring and the duties of a forest master, or other authenticated certificate as to a sufficient knowledge of the above-mentioned branches. Together with these they are required to produce—

"D. An engagement on the part of the parents or other respectable person to be responsible for the pupil's support in the institute.

"If the applicant be under age these papers must be accompanied by his parents' or guardian's written approval of his intention to enter the institute.

"Section 14.—The number of ordinary pupils shall be determined by the imperial senate on the representation of the forest bureau; should persons desire to be admitted to the institute without any of the certificates mentioned in rule 13 E, provision is made for their going through either a part of the course of study followed at the institute, or the whole of the course if opportunity permits, on the special representation of the forest bureau, with the concurrence of the imperial senate that these persons may be received into the institute as extraordinary pupils. The director is bound yearly before the 15th May to advertise in the Allmânna Tidning respecting the vacant places for pupils in the institution, and what concerns the same.

"Section 15.—The requests for admission to the institute given in to the director before the prescribed time according to rule 17, and the other documents therein specified, must be handed by him without delay, together with his own opinion on the same, to the forest bureau, whose duty it is to decide who shall be received as pupils, and by preference those who are properly certificated; and the bureau is bound to inform both the director and the pupils who are accepted.

"Section 16.—The name of each pupil must be inscribed at his entrance in the matriculation book of the institute, with the record of his number, name, birthplace, and date, what school he has attended, the nature and contents of the certificate, together with what preparation the pupil has had beforehand. In the matriculation book shall also be indicated when the pupil has fulfilled his course, his position in the institute, his progress in knowledge, and a judgment as to the skill he has acquired.

"Section 17.—Each pupil shall pay at his entrance into the institution forty Finnish marks, which sum shall be applied to procuring books, periodicals, instruments, &c., and which money shall be accounted for by the teacher according as provided for in sections 38 and 39.

"Section 18.—The pupils receive free instruction, lodging, and heating in the institution, but they must provide themselves with bedclothes, meat, and light, according to the regulations of the institution fixed by the forest bureau.

"Section 19.—Extraordinary pupils are subject to the same rules and regulations as those prescribed for ordinary pupils.

"Section 20.—Pupils who have not in the time prescribed in section 25 obtained sufficient knowledge to entitle them to the degree of forest conductor, may, with the consent of the director and the teachers, remain in the college for other two years.

"Section 21.—In the case of persons under age they may not be discharged from the institute before their course is finished and the certificate of dismission is given them, without the written consent of their parents or guardians.

"Chapter IV.—The instructions, the examinations, and the certificates of proficiency.

"Section 22.—The year of instruction in the institute begins on the 15th

August, and is divided into two terms; to wit, the autumn term, from the 15th August to the 15th December, and the spring term, from the 15th January to the 15th June. The pupils must, under the guidance of the director, the teacher, and the forest master, carry out for the sake of practice the measuring of fields and wood, as also the estimating of wood during the time from the 15th July to the 15th August During the terms and times of exercise the pupils shall have Sundays and holidays during the Easter festival.

"Section 23.—Instruction with practical exercises shall be communicated in the institution on the following subjects:—

"*A.* Forest science.

"Encyclopædic view of Forest science, modern doctrine relative to the planting and restoration, the protection and the management of woods, and doctrine relative to the economy and rules for cutting the same.

"Forest technology.

"Forest mathematics.

"Forest taxation—or determination of quantity of produce to be withdrawn.

"Forest botany, together with the anatomy and physiology of arborescent plants.

"Zoology in so far as it relates to animals to be found in Finland which are profitable or disadvantageous for wood.

"The doctrine of hunting.

"*B.* Geodesy.

"Land measuring with special respect to the requirements of forest service.

"Levelling.

"*C.* Science of engineering.

"The construction of country houses, bridges, roads, and dams.

"The draining of lakes and mosses.

"The construction of floating barriers and such like, together with the manner of floating timber.

"*D.* Rural economy.

"The most general rules of agriculture, and especially about the surface of the earth, the taking land into cultivation, the management of meadows and enclosures.

"*E.* Legal economy.

"Legal rights of lands as well as of ground and buildings, in which information is needful for the forester, together with legal arrangements relative to woods, fishings, huntings, waterways, and waterworks, and to the floating of timber.

"*F.* Drawing.

"Map drawing and linear drawing.

"Section 24.—The complete course in the above-named subjects shall embrace two years or four terms, and instruction shall be communicated to the two classes by the director, in legal economy, and in that part of forest science which is not taken up by the forest master. By the teacher instruction shall be given in geodesy, rural economy, and drawing; and by the forest master in forest mathematics, the doctrine relative to animals profitable or destructive for wood, the doctrine of hunting, and the sciences of engineering. The hours of teaching shall be divided for each class and each subject and teacher in accordance with the following table:—

Teachers.	Hours in the week.		Total.
	1st class.	2nd class.	
Director	7	7	14
Teacher	7	7	14
Forest master	7	7	14
Total	21	21	42

"The hours of teaching are from nine to twelve in the forenoon, and three to four in the afternoon, including in these lectures, repetitions, questions, and practical exercises, with which last named pupils ought to occupy themselves in order to obtain freedom and experience in the work.

"With respect to special experience which certain of the staff of instructors may possess in special branches of the above-named sciences, there may, on the representation of the forest bureau, be certain modifications made in the above-presented division of the subjects of instruction amongst the teachers, with the reservation that the said alterations shall be taken into the programme in accordance with the rule in the next section."

(*To be continued.*)

Forthcoming Sales of Home-grown Timber.

BERKS.—Alex. Davis, of Newbury, 4th Dec., at Woolhampton Estate. Badcock and Dyke, of Faringdon, 6th Dec., on Buckland Pusey, Carswell, and Stanford Place Estates. ESSEX.—Mr. Cheffins, of Saffron Walden, 3rd Dec., on Audley End Estate. GLOUCESTER.—Bruton, Knowles, and Bruton, 6th Dec., at Lea. James Karn, of Newnham, 11th Dec., on Haie Estate. Octavius Long, of Stonehouse, 7th Dec., on Kilminster Farm, and 12th Dec., on property of Tyndal's Charity. LEICESTER—S. Jackson, of Loughborough, 3rd Dec., on Prestwold Estate. LINCOLN.—R. Mackinder, of Spilsby, 3rd Dec., at Spilsby. NORTHAMPTON.—Beesley and Son, of Towcester, 3rd Dec., at Duncote, and 6th Dec., at Reade. SHROPSHIRE.—Barber and Son, of Wellington, 11th Dec., at Shrewsbury. SOMERSET.—Wm. Palmer, of Plox House, Bruton, 5th Dec., at Ansford.—*Timber Trades Journal*, Nov. 24, 1877.

The Construction and Maintenance of Roads.

By ALFRED J. BURROWS, Pluckley, Kent.

Independently of the luxury afforded to travellers of all classes by sound and clean roads, their commercial value is so great that their existence in any locality considerably enhances the worth of property generally, and of woodland in particular; for it is a fact well known to foresters that a good outlet for a fall of timber or coppice, especially when the timber is of large dimensions, in direct communication with good roads leading to the saw-mill, to a railway station, or to water carriage of any kind, frequently adds very considerably to the market value of the commodity.

The surveyor who chooses for his line of road the highest available ground, insures perfect drainage, selects the best materials, and has them finely broken down, economizes in every sense, and combines in his operations all the elements of success. As the constructor of a public road, he cannot be expected to sacrifice economy to the picturesque, or to lose sight of the mathematical axiom, that the shortest distance between any two points lies in the direction of a straight line; at the same time he need not be oblivious of the fact that in laying out two miles of road such a curve may be obtained as will never allow more than one-eighth of its entire length to be seen from any given point in its course, and yet it will only exceed the straight line by 150 yards.

In laying out an entirely new road for ordinary traffic, the first point to be ascertained is the relative levels of its extremes, so that during the progress of the work the amount of excavation may be proportioned to the necessary filling up of hollows, and no useless expenditure of material or labour be occasioned. The operations of the road-maker must also be regulated by the available supply of proper materials and the facilities for obtaining them.

The width of a road should be proportioned to the amount of traffic it will have to carry. Ordinary country roads need not be stoned to a greater width than eighteen feet. The experience of the last few years, since traction engines have become common on country roads, has shown the necessity of thoroughly bottoming all roads designed for heavy traffic. Where good stone is within reach, commence operations by excavating the new line to a depth of 18 or 20 inches below the level of the intended roadway; and to insure a firm

bottom place a layer of flatish stones from 6 to 9 inches in thickness, according to quality, over the whole road-bed, and well ram them down with a heavy wooden rammer, filling up all the interstices with smaller stones. The bottom stones need not be of the best quality. Next lay on 6 or 7 inches of good road-stone broken into cubes of 2 or 2½ inches, and consolidate the whole by rolling or carting over it. Finish up with 4 or 5 inches of still finer stone broken to about 1½ inch gauge, strew over the surface some fine gravel or chippings from the quarry, and well water and roll the whole. The practice of leaving the surface of roads to be smoothed and broken down by high-mettled horses and expensive carriages is, to say the least, a foolishly costly one.

Where stone is not to be obtained in sufficient quantities, or at such a cost as to warrant a liberal use of it in paving or bottoming a road, a good substitute may be obtained by using burnt clay or ballast. In many districts, such as the Weald of Kent, where good road-stone is scarce, the clay makes excellent ballast, and may be dug and burnt at a cost of about two shillings per cubic yard, including fuel. The digging and burning may be done for about a shilling or thirteenpence; and a chaldron of breeze, which costs from 7s. 6d. to 9s. on the spot, will burn from nine to twelve cubic yards, according to the size of the heap and the skill of the burner. Concrete bottoms are sometimes recommended; but they are expensive, and have the disadvantage of allowing no water to pass off through them. At all points where roads intersect, or traffic is concentrated—as in gateways—greater strength should be given.

The convexity of roads is a matter upon which great difference of opinion exists. McAdam and Telford, who were the pioneers in good road-making in England, maintained that for a road thirty feet in width a fall of three inches from the centre to the side is sufficient. Such a convexity gives a fall of only one in sixty. On the other hand, Mr. G. A. Dean, referee to the Board of Trade, and a man of large and varied experience, recommends one in thirty, or a fall of six inches from the centre to the side. Where the road lies low, and the drainage is in any way defective, the directions of the latter may be safely followed. In all cases the thickness of the various layers of stone should be greatest in the centre of the road, and gradually decrease towards the sides. An extreme variation of three or four inches in the whole will be sufficient.

No permanent smoothness of surface or regularity of wear can be insured without the use of finely broken metal. The amount of surface touched by the wheel of a carriage at any one time is seldom more than a superficial inch. The larger the stone the greater the leverage it affords to the wheels of vehicles and the shoes of horses,

and the less its chances of remaining firmly imbedded in the roadway.

Stone in a very dry state possesses less power of resisting attrition than when damp, or only moderately wet, as its elasticity is then much less; hence the necessity for watering roads in dry weather. And, paradoxical as the statement may appear, at no time of the year does a liberal watering do more good than at the time when a hard frost breaks up without rain. The watering raises a sludge, which may easily be scraped or swept off with the smallest amount of injury to the road. An old roadman, of wonderful sagacity and great powers of observation, assured the writer that what he most dreaded on the breaking up of a frost was the passage of a flock of sheep over his roads. Whoever has followed under such circumstances may have observed that the sheep pick up with their feet and disintegrate the entire surface.

For cleaning roads, the brush is much to be preferred to the scraper, as the latter drags up all small loose stones, and thus prepares the way for the percolation of water through the upper stratum.

The drainage of roads is a matter of primary importance, and should be secured at any reasonable outlay. Good open ditches along the sides of roads afford the most effectual means of doing this. They should be of sufficient depth, and so arranged as to carry off the water from the bottom of the road as well as from its surface. Under all circumstances, they are better placed on the field side of the hedgerows, and not between these and the road; for, besides the danger to travellers in narrow roads, ditches are liable to constant filling in and derangement by the traffic. One great advantage of placing the ditch on the field side is that in pastures the hedge is so much more out of the reach of cattle. In many parts of Kent, at the present time, miles of roadside ditches are being filled up by the passing of traction engines. Into the open side ditches, drains either of pipes or stone should discharge the water from the foundations of the road. Where a roadway runs along the slope of a hill, a pipe or stone drain should be laid at a good depth on its upper side, and the water carried to the lower side by cross drains running under the road.

A road once properly constructed should never be allowed to wear into deep ruts so as to lodge water, for immediately these are formed all the traffic runs along them, and the road is soon cut through. By keeping these well filled in, an even wearing of the whole road is secured, and the cost of maintenance is greatly diminished. The accumulation of dirt also keeps the road in such a sodden state that wear and tear are greatly accelerated.

Where there is a choice of road materials, granite, quartz, basalt,

or whinstones are preferable to limestones, as neither the latter nor the various kinds of sandstone are sufficiently strong. Flint, gravel, and pebbles will not alone form a solid bottom, though they may be used in conjunction with other stone. Upon the surface, both gravel and flint wears down rapidly. A mixture of flint stone and the best kinds of Kentish rag makes a good and durable road; and if a proportion of fine or broken shingle be added, its wearing powers are much increased.

All the materials for repairing roads should be deposited at their sides during the summer months, and broken and put on before the beginning of winter, as they seldom settle well after frosts set in. Where the materials available for coating a road are not of a nature to bind well together, a more compact surface may be obtained by floating it with thick lime-water into which has been stirred a small quantity of iron rust, or some of the flakes which fall from the red-hot iron under the blows of the smith's hammer. The iron produces an oxidation which causes the whole mass to adhere firmly. Some kinds of limestone also, when broken down finely, and laid on to a considerable thickness, will partially unite and form a road sufficient to carry a fair load over any ground upon which a man could previously walk with safety.

The subject of laying out and constructing wood-rides, with some general remarks on the theory of road-making, must be reserved for a future paper.

(*To be continued.*)

Osiers.

By WILLIAM SCALING, Basford, Notts.

My reason for not replying to H. S. in your October issue was because his questions on osier-growing were not sufficiently definite to admit of a reasonably short answer, but I feel bound to do so now, because the answer given by D. D. is calculated to mislead. The advice he gives is at least fifty years behind the times, and if followed must result in failure if the produce so grown has to be sold in the open market. What does H. S. call suitable soil? for in this matter popular opinion is at variance with modern experience, and the soil or situation that is suitable for one class of willows is very unsuitable for others. Also what is the nature of the shelter he alludes to? No one can give a satisfactory reply to his questions in the absence of this information. I will, however, give a few general rules, in the hope that H. S. may be able to apply them in his own case. In England there are about seventy varieties of willow cultivated for basket-making purposes, and nearly all those are comprised in three distinct species. Among such a number of kinds it will easily be understood that there must be a great difference in quality, and consequently a great difference in value, the best sorts being about three times the price of the commonest. The commonest sorts, however, can be improved by attending to certain ascertained rules. For example, the quick-growing sorts should not be planted in rich alluvial soils, they show better results when grown on a strong poor soil, whilst those of a hard texture and slower growth are correspondingly improved by a rich soil. Again, the distance apart at which to plant must be regulated by ascertained rules. It would be absurd to plant willows that grow 11 to 14 feet in a season as closely as those that only grow 4 to 5 feet, but the commonest and rankest class of osier should never be planted more than 2 feet apart each way. The old style of wide planting has been exploded years ago. A good uniform rule for planting common large growing willows is 2 feet by 18 inches, and for the finer sorts 22 inches by 16; some even grow best, and produce the best results, 16 inches by 8, or only 1 foot of space for each cutting. When willows are planted too far apart they grow crooked, coarse, and of small value, however heavy the crop may be.

The price of cuttings is entirely dependent upon their purity or freedom from any admixture, the sort of willow, and the rarity—new varieties when good fetch large prices. The commoner class, known simply as *osiers*, without any distinctive character or guarantee, can be bought for 10s. or 12s. 6d. per 1,000—selected sorts, true to name, 15s. to 20s. per 1,000.

Willows do not require much shelter, they are better without it, except in very exposed situations; and even then, much the best screen or shelter is to plant a few rows of the common osier, or better still a few rows of *Salix acuminata*, round the outside of the plantation.

In conclusion, no one can advise what sort to plant without knowing the locality, because the sort of willow that suits one market would hardly find a buyer in another district; therefore it would not be justifiable to advise H. S. to plant a sort in the south of England that could only be sold in the north to advantage.

Coniferæ at Mells Park, Somerset.

By GEORGE BERRY, Forester, Longleat.

The late Rev. J. S. H. Horner was well known as an ardent lover of trees, and an enthusiastic admirer and collector of Conifers, with which he commenced forming a Pinetum at his seat, Mells Park, Somerset, about the year 1845, in which he planted most of the Coniferæ then known to be hardy enough to withstand the climate of Great Britain. His son, the present worthy proprietor, is an equally enthusiastic admirer of Conifers, and is continually adding some rare or choice specimens to the already rich and extensive collection.

The Pinetum occupies one of the hanging portions of the park, with a fine exposure and a good soil; but unfortunately the subsoil is one of the least favourable upon which to establish a collection of Conifers, the large proportion of lime it contains being too great for them to flourish in perfection, the result of which is that some of the oldest specimens present a rather rusty and stunted appearance. There is a great variety of the choicest Conifers grown, as may be judged from the annexed list, some of which are rather uncommon, and decidedly merit a few remarks. *Pinus Ayacahuite* is a distinct and beautiful variety, and is a healthy and thriving specimen. This tree somewhat resembles *Pinus excelsa* in its habit and the length of its leaves, but the colour of the latter is nearer to that of *P. strobus;* it is, I believe, a very rare specimen—indeed, it is the largest and finest specimen of the kind I ever remember to have seen. *P. romana* is a distinct variety, its globular-shaped head of very dark green foliage being exceedingly striking and conspicuous. *P. Monticola* is a beautifully neat and pretty-looking Conifer; it is healthy and thriving. *P. Escarena, P. lemoniana, P. Pallasiana,* and *P. pyrenaica* are robust specimens; they are, however, to my mind, coarse-growing trees of the pinaster type. *Wellingtonia gigantea* is thriving beautifully in the clay of the coal measures, and the specimens exhibit healthy, robust pyramids of foliage.

Probably if the Pinetum had been formed on the clay, instead of the conglomerate and limestone formation, the Conifers generally would have been much larger and healthier now than they are. *Picea grandis, P. Cephalonica, P. Nordmanniana,* and *P. pinsapo* are all beautiful varieties, and they are each making a clean, free, rapid growth, and promise in time to make grand specimens.

Abies Albertiana is growing freely; it is the most graceful of all the Spruce species, and is at the same time a rapid grower, and does not possess such a strong tendency to a bushy habit of growth as is exhibited by its congener the Hemlock Spruce (*Abies Canadensis*); its foliage, too, is a darker and better green than the latter. *Abies Orientalis* is a pretty specimen, and it is a most eligible subject with which to adorn a lawn. Its short neat soft green foliage and symmetrical habit of growth are its most distinctive and attractive features. *Abies Douglasii* and *A. Smithiana* are of a robust habit of growth, but both are graceful and handsome specimens. *Taxodium sempervirens* is well represented by a fine, vigorously grown tree; it would have been probably the tallest specimen in Britain had it not lost its leader for several years; it has, however, now formed a new leading shoot, and promises to thrive well. The three Cypresses are elegant and noteworthy specimens, each presenting a distinct and beautiful habit. The *Araucarias* are good specimens, but are not in a very healthy state. *Fitzroya Patagonica* has a very graceful drooping habit, but its foliage presents a rusty appearance; indeed, I never saw a plant of *Fitzroya* otherwise; and I doubt if it is at all suited to our climate, unless in the very mildest and moist localities, with a climate approaching its native habitat on the Pacific slopes of the mountains of Patagonia. There is also a large collection of the newer kinds of recent introduction, many of which give good promise of forming beautiful specimens in the course of a few years. To all lovers of Conifers a visit to Mells Park, and an inspection of its fine collection of rare and beautiful trees, cannot fail to be both instructive and interesting.

Scottish Arboricultural Society.

The twenty-fourth annual general meeting of the Scottish Arboricultural Society was held on Tuesday, 6th Nov., in the rooms at the Royal Botanic Garden, Edinburgh. There was a good attendance. The Right Hon. W. P. Adam, of Blairadam, M.P., President, occupied the chair. Among those present were Sir Robert Christison, Bart., Professor Balfour, Dr. J. Croumbie Brown, Professor M'Nab, Dublin; Dr. Cleghorn, Robert Hutchison, Esq., of Carlowrie; Dr. Craig, Mr. McCorquodale, Scone; Mr. Gorrie, Rait Lodge; Mr. McGregor, Ladywell, Dunkeld; Mr. McLaren, Hopetoun; Mr. Loraine, the Riding Mill, Northumberland; Mr. Buchan, Secretary Scottish Meteorological Society; Mr. Rider, *Journal of Forestry*, &c.

President's Address.

The President, after the meeting had been duly constituted, opened the proceedings with an Address, in which he said that it was a matter of great gratification to him to observe the gradual and steady progress which the society was making, not only in the number of its members, but in the influence and authority with which it speaks to all connected with arboriculture; and he would urge on all landed proprietors, and all foresters engaged in that interesting pursuit, to lose no time in joining its ranks. As a proof of the great usefulness of the society he might refer to the printed Transactions, wherein almost every point of interest connected with the art of forestry has been touched upon.

While many of the papers are most valuable contributions to the literature of arboriculture, there are none from which something may not be learnt, and in which valuable suggestions are not made. The society had the good effect of inducing practical foresters, men actually and every day engaged in the work, to come forward and put in writing their own practical experiences, thus making them sure and safe as to the knowledge that they have already acquired, and enabling them to impart their information to others. No society, however, could be carried on without adequate funds and membership, and both these, as he had already said, were steadily increasing; and it was to be hoped that the present appeal to landowners and foresters would not be in vain. When they looked back at what the income of the society was in 1858-59, and compared it with the present position, they had much reason to be pleased. In 1858-59 the number of the members was 168, and the income £39 10s. In 1861-62 the members numbered 158, and the income £30 12s. 6d. In 1866-67 the membership had increased to 284, and the income to £140 6s. 10d.

In 1874-75 the members numbered 726, and the income £304; and in 1876-77 it rose to 746, with an income of £351. This gratifying advance they owed in a great measure to the valuable services of his distinguished predecessors in the chair,—Professor Balfour, Dr. Cleghorn, and Mr. Hutchison, of Carlowrie. To all of these the society is most deeply indebted. Professor Balfour has a European reputation, which renders it an honour to any society to be presided over by him. Dr. Cleghorn, to the great experience that he has acquired by a lengthened and distinguished service in India, where he acted in a responsible and high position in the forest department, adds the great love which he bears to the science, and the deep interest which he has always shown for it since his return to this country. As to Mr. Hutchison, he has been the life and soul of the society ever since its commencement, and he doubted very much whether if it had not been for his great and continuous exertions, and for his most valuable contributions to the literature of arboriculture published in the Transactions of the society, we should have been at this day in the vigorous existence which we happily enjoy. He could not pass on without saying a word of praise and encouragement on the establishment of the *Journal of Forestry*. That journal was established only this year, and he hoped it would become the organ of the society, as well as the organ of British Forestry in general. It is creditable to the founders that it was established entirely independently of the society, and has not trenched in any way on its funds. He was glad to observe that peculiar facilities are offered to under-foresters and others for obtaining the journal at an easy rate. Advantage should be taken of its columns to make known to the public generally all that is interesting and instructive on the subject of arboriculture, and he hoped the staff and contributors may have all the success they deserve for having undertaken a useful, instructive, and possibly as yet a not very lucrative work. He observed in the history of the society that in 1871 the Queen was graciously pleased to become a patron, and at the same time they became affiliated to the Royal Society, which he considered was a great step in advance. These two additions to the dignity and importance of the society ought to be followed by another, viz., a Royal Charter, and if he could do anything towards obtaining that object they might command his services. On being called to the distinguished position of president he had asked himself what his claims were to such an honour. He could at least say that he was a practical woodman, accustomed from his earliest youth to the use of the axe, and delighting both in the exercise and the interest that it gave, and thus they would recognise in him a faithful follower of his late distinguished chief and leader—Mr. Gladstone, whom one often heard derided for his partiality to woodman's work, but he was sure in that company, whatever their political opinions might be, and whatever they might think of him as a statesman and an orator, they could all appreciate this trait in his character. His other claim to the position was that he came of a race of planters and foresters. He was the fifth in succession who had specially devoted himself to improving the estate of Blairadam—more by planting

than by anything else. The planting of Blairadam had become classical through a touch of the magic wand of that enchanter, Sir Walter Scott. To this he owed the record of what had been done at Blairadam since 1733, which, together with directions and instructions for future management, was embodied in a book which was written and printed in 1834 by his grandfather, William Adam, the Lord Chief Commissioner of the Jury Court in Scotland. Blairadam in its original unimproved state was a wild unsheltered moor, lying from 500 to 700 feet above the sea, with a certain amount of natural beauty, but only having one enclosure and one tree, an ash, which, though it still grew vigorously, was far outtopped by the younger generation. It was an unpromising land to work upon, but he knew of no instance in the improvement of waste land that more thoroughly illustrated the value and advantage of judicious, continuous, and persistent planting than this estate. It would take too long to go into the whole story of the planting and improvements, but these are recorded in a book which owes its origin to a suggestion coming direct from Sir Walter Scott, and the story is related by Lockhart in his life of Scott in the following words :—

"Since I have obtained permission to quote from this private volume, I may as well mention that I was partly moved to ask that favour by the author's own confession that his 'Blair Adam from 1733 to 1834,' originated in a suggestion of Scott's. 'It was,' says the judge, 'on a fine Sunday, lying on the grassy summit of Benarty, above its craggy brow, that Sir Walter said, looking first on the flat expanse of Kinross-shire (on the south side of the Ochils), and then at the space which Blair Adam fills between the hill of Drumglow (the highest of the Cleish hills) and the valley of Loch Ore, what an extraordinary thing it is that here to the north so little appears to have been done, when there are so many proprietors to work upon it! and to the south, here is a district of country entirely made by the efforts of one family in three generations, and one of them amongst us in the full enjoyment of what has been done by his two predecessors and himself." Blair Adam, as I have always heard, had a wild, uncomely, and inhospitable appearance before its improvements were begun. It would be most curious to record in writing its original state, and trace its gradual progress to its present condition.' Upon this suggestion, enforced by the approbation of the other members present, the President of the Blair Adam Club commenced arranging materials for what constitutes a most instructive as well as entertaining history of the agricultural and arboricultural progress of his domain in course of a hundred years, under his grandfather, his father, and himself. And Sir Walter had only suggested to his friend in Kinross-shire what he was resolved to put into practice with regard to his own improvements on Tweed-side ; for he began at precisely the same period to keep a regular journal of all his rural transactions, under the title of 'Sylva Abbotsfordiensis.'

The silver fir at Blair Adam has always flourished luxuriantly, and was the most remarkable species of tree on the estate. There were four

still living, of which he had the dimensions in 1811, in 1851, in 1862, and in 1877.

	1811.	1851.	1862.	1877.
1.	8 ft. 4 in.	13 ft. 0 in.	13 ft. 6 in.	13 ft. 9½ in.
2.	8 ft. 1 in.	12 ft. 1 in.	13 ft. 0 in.	13 ft. 3½ in.
3.	10 ft. 5 in.	12 ft. 11 in.	13 ft. 0 in.	13 ft. 0 in.
4.	9 ft. 5 in.	11 ft. 5 in.	12 ft. 0 in.	12 ft. 0 in.

These trees were planted about 1754. In addition there were one 15 ft. 3 in. in girth, one 15 ft. 1 in., one 14 ft. 8 in., five between 13 ft. and 14 ft., six or more between 12 ft. and 13 ft., and a great many others between 11 ft. and 12 ft. and between 10 ft. and 11 ft. These were probably planted between 1754 and 1757. There were also three remarkable hemlock spruces planted about 1757, which had a girth of from 10 ft. to 12 ft. There were also many fine examples of the larch, spruce, and Scotch fir, as well as beech and oak, but the silver fir and hemlock constitute one of the most remarkable features of the place. He was afraid that these trees had almost ceased to grow, and that their gradual decay might now be looked for. He had dressed some of them with compost, but without producing any perceptible advantage. He then proceeded to urge the necessity of establishing a School of Forestry in this country, and referred to the thorough and energetic manner in which Dr. J. C. Brown had taken up the subject, and as president of the society he cordially endorsed and enforced what had been so well begun. There would be, no doubt, some difficulties in obtaining recognition from Government of this necessity, and it would probably not be till after a long period of pressing application, and till public opinion had been brought to bear, that the public purse-strings would be drawn. Another difficulty was the fact that, whatever may be the case in India and the colonies, we have at home no large forests under the charge of Government, and this was an obstacle in the way of the practical education of foresters; still, in spite of these difficulties and drawbacks, he considered that in a country like this, with so many dependencies and colonies where a knowledge of the science of forestry is so necessary, it is absolutely essential that a School of Forestry should be established. It was the duty of the Society, therefore, to awaken intelligent interest in this question, and he for one would be glad to do all that he could in and out of Parliament to further this praiseworthy object. He would have wished further to illustrate the necessity for good Schools of Forestry by what was now taking place in India. The wanton destruction of forests in that country had been going on for years. Who could say that the terrible famine which was now devastating some of the fairest provinces of that empire might not be directly traceable to the improvidence of man in denuding the country of its natural vegetation, and so altering all the climatic arrangements of Nature? In conclusion he would only say how much honoured he felt at having been chosen their President, and how much pleasure it had given him to be present at their meeting, to

testify by his presence the great and enduring interest he felt in the society, and in all that pertained to the enchanting science with which it deals.

Professor Balfour asked the meeting to join with him in returning their warm thanks to the President. A more practical and valuable address he had never heard. (Applause.)

Dr. Cleghorn seconded the motion. In referring briefly to the proposal to establish a school of forestry, he remarked that its need was generally admitted.

The President, in returning thanks, said that the Society as it became better known would no doubt be joined by many landowners and others, when it would acquire that strength which it deserved to possess, and be able to speak with greater authority as to the establishment of a School of Forestry. He had a strong opinion as to the propriety of establishing the school, and he should certainly do what he could to press it upon the notice of Government. Of course it would be difficult to prevail upon the Chancellor of the Exchequer to draw his purse strings, except they got public opinion upon their side. They should get the press to take up the matter and impress it upon all public men, so that it would be brought under the notice of the Government. As to obtaining a Royal Charter, it would certainly be of great use to the society if they were recognised in that way. The society was now fully established, and gave proof of its vitality and progress in the future. (Applause.)

Report of Proceedings of Council.

The Secretary read the report of proceedings of Council, which gave the names of a number of local secretaries who were proposed for election. It was also recommended that Scone Palace and Blair Athol, in Perthshire, should be selected as the places to be visited next summer.

Election of Members.

Thirty-three new members were proposed and admitted.

Financial Report.

Mr. Crichton, treasurer, said that to a certain extent they were more successful than last year; but they had encroached upon a sum of money they had in hand to the extent of £8 15s. The funds now amounted to £319 10s.

On the motion of Mr. R. Hutchison, of Carlowrie, it was agreed to invest £300 in the name of the trustees appointed for that purpose.

Meteorological Experiments.

Mr. Alexander Buchan, convener of the meteorological committee, and secretary of the Scottish Meteorological Society, submitted the report on the meteorological experiments at Carnwath. He said that, owing to various difficulties, it was not till 8th March that he was able to go out with the thermometers and place them in position; and then a complete rearrangement of the whole system was proposed and carried out. He had given considerable time to the examination of what had been done and was

doing in the great forests of Germany, in working out the problem of the influence of forests on climate. As some of them would be aware, meteorological observations were carried out there of a very elaborate character. At each forest station three distinct positions were fixed upon. In the centre of an open field, covered with grass, two or three hundred yards from the forest itself, so as to be perfectly uninfluenced by the trees, thermometers were placed down. Then thermometers were placed at the top of a tree in the heart of the forest; and again at the foot of a tree, where they were screened from sun and light. Underground thermometers were also placed down, and the whole of these were observed several times a day. Looking at the results obtained after several years of observation, he found that, taking the mean temperatures in the open spaces outside, and comparing them with the temperatures near the top of the tree, they had all but identity. There were differences between the temperatures on the grass at the surface of the earth and at the top of the trees at certain hours of the day, but he spoke simply of mean results. Comparing the thermometer at the top of the tree with that at its foot, they had, however, a very great difference, the temperature being considerably lower under the trees than at the top or outside the wood. Looking at the underground temperatures, it was found that the temperature of the soil shaded from the sun by the trees in the heart of the wood varied from two to four degrees below the mean of outside of the wood under a full exposure of the sun but protected by the grass. At the society's station at Carnwath it was impossible to carry out the experiments so fully, owing to the want of observers and of elaborate sets of instruments. It was resolved that the step they should take at Carnwath would be to attempt to throw further light upon this question, viz., What effect had trees in modifying the temperature of the air around them, and the temperature of the soil in which they grew? and it was to that question that the committee should give attention for some time to come. It was so important, and it opened up so many practical questions, that he thought the effort should be made. At Carnwath the society had two sets of apparatus—one fully exposed to the sun's light and heat, and the other quite near, but completely sheltered from the sun. Besides those on the surface, underground thermometers were sunk at a depth of three, twelve, and twenty-two inches. Since 8th March till the end of July observations had been made. Taking the maximum and minimum of thermometers in the open space, they gave a mean temperature from March to July of 46·6, exactly coinciding with the mean of the dry bulb thermometers. The mean temperature of the thermometers in the boxes inside the wood, and protected by the trees, was 46·1, or exactly half a degree lower. March was the coldest month of the year, and during it the difference between the two was almost nil; but in summer the difference was much greater. The difference of the temperature on the soil in the two positions was even more marked, being greatest when the sun's strength was greatest. In July the soil in the shady position, three inches underground, was 3·2 degrees lower than in the open; at twelve inches, 3·5 degrees lower; and at twenty-two inches, 3·9 degrees,

They had thus an enormous difference, resulting purely and solely from shading of trees, a difference amounting to two degrees on the mean over the whole year. He concluded by pointing out that the observations carried out in Germany would lead to more exact scientific knowledge as to the results of forests on climate.

Mr. McCorquodale, Scone, said that he had carried out some experiments himself, and found that where the trees were crowded the temperature was lowest. The thinning of plantations admitted a greater degree of heat. Where the temperature of the ground was low, the growth of the trees was retarded, for the bark thickened and the flow of the sap was hindered.

The President moved that the thanks of the society be awarded to Mr. Buchan for his instructive report, and that the contribution to the Carnwath experiments be continued.

The motion was unanimously adopted; and thereupon the President vacated the chair, to fulfil other engagements, and his place was taken by Professor Balfour, senior Vice-president.

Prize Essays.

Mr. M'Gregor, Ladywell, convener of the judges, gave in the report on the essays submitted for the usual prizes. A silver medal was granted to Mr. C. F. Amery, forest department, North-West Provinces of India, for a Report on Indian Forests; a silver medal to Mr. James Hutton, Mackintosh Estate, Kingussie, for "Report on the Woods, Old and Remarkable Trees, and Young Plantations on the Mackintosh Estate in Brae Lochaber; with a description of the Soils on which they grow;" bronze medal for Report on Use of Dynamite and Tonite in Forestry, by Mr. D. F. M'Kenzie, Murthly Castle; silver medal for paper on the Movement of Fluids in Stems, considered in Relation to the Felling and Seasoning of Timber, by Professor W. R. M'Nab, College of Science, Dublin; gold medal for Collection of British Woods, by Mr. James Duff, Bayham Abbey, Tunbridge Wells; and silver medal for Rustic Work, by Mr. James Scrimgeour, Hopetoun House.

Office-bearers.

The following office-bearers for 1877-8 were elected:—President—The Right Hon. W. P. Adam, of Blairadam, M.P. Vice-Presidents—William M'Corquodale, Dr. Hugh Cleghorn, of Strobithy, Professor John Hutton Balfour, Bailie Methven, Robert Hutchison, of Carlowrie. Council—John Anderson, P. S. Robertson, Robert Baxter, William Stewart, John M'Laren, William Gilchrist, Malcolm Dunn, William Gorrie, James Robertson, Alexander Richardson, John M'Gregor, C. Y. Michie, John Grant Thomson, Charles S. France, D. Scott. Secretary—John Sadler, F.R.P.S., Royal Botanic Garden, Edinburgh. Treasurer—George Crichton, of Messrs. G. and M. Crichton, 18, Princes Street, Edinburgh. Auditor—John Ord Mackenzie, of Dolphinton, W.S.

Schools of Forestry.

Rev. J. Croumbie Brown, LL.D., read a paper on Schools of Forestry. He said that he would first supply some information with regard to existing schools of forestry; secondly, he would state what was the present condition of the question in regard to the establishment of a school of forestry in Britain, or elsewhere, among our English-speaking population; and in conclusion would refer to some subjects, the consideration of which by the Arboricultural Society would elicit information which would be of great value. The schools of forestry on the Continent were educational institutions, in which provision was made for leading candidates for employment as foresters through a protracted course of study, similar to what was required in Scotland as a preparation for the so-called learned professions of law, medicine, and divinity. Some three hundred years ago it was perceived by Tully, the distinguished minister of Henry IV., that France was being ruined by the destruction of her forests. The evil was not confined to France, and for 150 years various measures were devised and adopted with a view to averting the catastrophe; but it was found that they could at best only retard the destructive process. At length a method was adopted to secure simultaneously and without prejudice to each other a sustained production of wood and timber, to carry out which educated foresters were necessary.

He then laid on the table for the use of members pamphlets containing information in regard to the schools of forestry in France, Italy, Prussia, Spain, Russia, Sweden, Bavaria, Wurtemberg, Austria, Finland, Saxony, and Baden. In India, as in France and in Germany it was found that the forests were being destroyed, that their destruction was entailing sufferings and privation upon the people, and that more disastrous consequences were lowering in the distance. After careful deliberation, it was determined that a body of forest officials, educated at schools of forestry on the continent of Europe, should be formed.

This might have been considered a bold measure, but the results had justified the steps taken. By progressive amelioration of their condition, the Indian forests had risen greatly in value and had vastly extended, while the revenue from them had increased by hundreds of thousands of pounds. According to "Resolution of Government of India, financial department," No. 2012, dated 11th March, 1871, the latest to which he had access, the estimated charges for the following years (1871—72) was 4,511,000 rupees, (£451,100), and receipts 5,732,200 rupees (£573,220), showing a surplus of revenue over expenditure of 1,221,200 rupees (£122,120).

In 1873-4 the surplus was £285,000, both revenue and expenditure being about double what they were ten years previously. This was accomplished not by an impoverishing of the forests, but by a progressive amelioration of them and increase of their pecuniary value. In illustration of this assertion he quoted from a paper by Captain Campbell-Walker, on State Forestry. He then stated somewhat in detail the course of study followed at European schools, and remarked that there might be much in

such a curriculum which was not requisite for the management of British woods and colonial forests. On this point he had no desire to raise a controversy at this stage.

The position which he took up was this; the Government of almost every country on the continent of Europe had deemed it expedient to make provision for the instruction of officers in every department of forestry, and the British Government of India had deemed it expedient to do the same, and so far as existing arrangements permitted they had found their advantage in the result. In some countries the schools of forestry were distinct and separate institutions, in others they were connected with other educational arrangements, which in some were utilized, and, so to speak, made subservient to the education and instruction of the students of forest science. The advantages of the combinations were that many subjects might be studied by students of different faculties together, as was done in the arts classes of our Scottish universities, by students contemplating the study of theology, medicine, and law, and one staff of instructors then sufficed for the whole, with only special instructors for special subjects of study pertaining to the different professional departments. There were many advantages connected with the location of a school of forestry in the vicinity of a forest, in which from time to time illustrations of what was advanced in the class-room might be found. But this was not indispensable to the successful teaching of forestry. It might be said that one-half of the schools of forestry were not so situated, the students having to be taken to a distance to study practical forestry. He concluded by urging the institution of a school of forestry in Great Britain, and especially suggested that that school should be located at Edinburgh in connection with the new Arboretum, and with the forests of the Highlands.

Professor Balfour proposed a vote of thanks to Dr. Brown for his paper, and in doing so expressed his approval of the establishment of a School of Forestry in Edinburgh, and hoped soon to see it realized, although of the opinion that to learn forestry thoroughly and practically a man must go to the forests.

Dr. Cleghorn also spoke in favour of a school being established for the wants of this country. For practical purposes a large tract of forest was required.

The Preparation of Charcoal.

Mr. Robert Baxter, forester, Dalkeith Park, read a paper on "Woods for Making different kinds of Charcoal, and the Modes of Preparing it." A very useful charcoal, he said, could be produced from almost every kind of wood that grew, although he could not speak decidedly about the poplar, which, owing, to its scarcity had never been tested. The Wych elm, Spanish chestnut, and lime-tree they did not regard with much favour, owing to their peculiar bark, which offered great resistance to the charring process. Beech, sycamore, ash, thorn, oak, hornbeam, birch, alder, and laurel could all be used with perfect success as charcoal producers.

The yew and holly made a very superior charcoal, as they were very heavy, held well together, and had good heating qualities as fuel. There was a traditional antipathy to fir being used, and larch in particular, owing to a belief that it sparked, but this tradition, like many others, was false. He had seen larch charcoal frequently tested, and on no occasion did it ever emit a single spark, although the resinous nature of these trees rendered them not so safe as the hard woods, and care should be taken to have them well mixed with the latter when being charred. He believed that every forester had at his command a supply of wood that would make good serviceable charcoal, suitable for all cooking purposes, and that its quality would be very much improved if he could find time to strip the bark off the wood before charring. It was also worthy of remark that a good means of preserving the heavier charcoal from crumbling down was to split instead of sawing up the wood when preparing it for the kiln. Considering the method of charring, he said that the usual way to do it was in the open air in kilns, formed by piling the wood together and then covering it over with turf. After explaining the process in detail he said that this plan was perfectly safe and practicable, having been carried out for the last fifty years at least at Dalkeith Park, and the charcoal had given general satisfaction. But this year it had been given up for various reasons. In the first place it was killing work for the men, strong fellows being at the end of three months often brought to the lowest verge of physical prostration. Another reason was that it had to be done in the summer season, when the days were longest, and it so happened that this was also the oak-peeling season, when men could ill be spared. A third reason was that it entailed a great waste of material. Every kiln took a load of turf to cover it, very little of which could ever be used a second time. Then for every ton of charcoal produced there was a loss of two tons of wood, which either disappeared in combustion, or was reduced so small as to be unfit for use. It had been proved that four tons of wood when charred on correct principles, would yield one ton of good charcoal, and as by this system six tons were required to produce the same quantity, the waste would be seen to be a very serious item. Having abandoned this open-air system, they had adopted that of charring the wood in two large cylinders or retorts, similar in every respect to those used at the powder works. These retorts were seven feet long by three feet six inches in diameter. The wood was cut in two lengths, averaging from two to six inches in thickness, the smaller sizes being laid on the bottom and the heavier at the top, because of the flues being so constructed that the fire struck the top of the retort first. Care being taken to exclude air, the fires were set agoing. On an average it was found that sixteen hours were required to char the wood properly. When this had been done the fire was drawn out and the retorts allowed to cool for five or six hours. The lids were then removed, and the charcoal drawn smartly out into large pans, which were at once closed with a tight-fitting cover, so that in a very short time the fire was effectually smothered out. At some places the vapour expelled from the wood was condensed, and formed the basis of many useful products. It was unnecessary to point out the advan-

tages of this system. It could be carried out at any season of the year; indeed, in the event of a snowstorm shutting them out from other employment this could be carried on as briskly as in the middle of summer. Although he could not submit statistics as to the cost, he knew that it would be considerably less than under the old system.

Various members expressed their indebtedness to Mr. Baxter for his interesting paper, and the remark was made that nothing troubled a forester more than burning charcoal in an ordinary turf kiln.

Cryptogamic Plants.

Mr. Malcolm Dunn, Dalkeith, read a paper on "Cryptogamic Plants Injurious to Forest Trees, and their Remedies." The class Cryptogamia, he said, formed a very numerous section of the vegetable kingdom, and included all those genera the flowers of which were either absent or formed on a plan different from that of ordinary flowering or phænogamic plants, and the reproductive organs of which were not true seeds containing an embryo, but mere cells enclosing a granular matter, which by germination produced a thread, or mass of threads, a cellular body, a membrane, &c., as the case might be, which either at once gave rise to the fruit or to a plant producing fruit. Many of the genera of cryptogams were more or less injurious to plant life, and one very important class of diseases amongst trees and timber arose from the attacks of parasitic fungi. A notable instance of a serious attack of fungus upon some fine young trees of *Wellingtonia gigantea* had come under his notice. In the summer of 1865 a row of about twenty Wellingtonias, which were growing in a light loamy soil, on an open, dry, gravelly subsoil, in a moderately well-sheltered situation, began to show unmistakable signs of failing health, and upon examining the roots he found them to be completely swathed in the mycelium or spawn of a fungus, which had worked its way under the bark of the roots and stem in several of the trees, so as to completely choke up the alburnum or sapwood, rupturing the vessels, and entirely preventing the circulation of sap, and thereby causing the death of the tree. When examining the roots of the Wellingtonias he found the ground in which they were growing full of old tree roots in all stages of decay, forming a perfect nursery of fungus spawn. Having stated what steps were taken to remove the roots and fungi, viz., by trenching and carefully removing every particle of decayed wood, he said that a number of the Wellingtonias which had suffered by the fungus were then replanted, and had since quite recovered. Neither had there been any signs of the reappearance of the fungi, although several seasons since 1865 had been quite as favourable as that season was for its production. Another instance occurred in a small mixed plantation of ash, Spanish chestnut, hornbeam, poplar, willow, and hazel, which was planted in 1857-8 upon ground that had been cleared two years previously of a crop of large oak, ash, elm, and beech, and in which all the old stumps and roots were allowed to remain. The ash,

poplar, and willow began to fail in 1861, and by 1863 there was scarcely a plant alive upon an area of about six acres. On pulling up the dying plants he found the roots covered with the spawn of fungi, which permeated the bark and alburnum; and as the plants decayed, it penetrated their woody tissue, hastening its rapid decomposition. The mycelium in many cases reached a height of from one to three feet up the stem of the young trees before the tops were quite dead, and it could be seen bursting the bark at the base of the stem, and displaying a complete network of white threads of spawn inserted between the bark and the wood. A few of the hazels were also affected and died, but none of the Spanish chestnut and hornbeam appeared to suffer in the least, although they were intermixed throughout the plantation with the other kinds which were killed by the fungi; hence it would appear that certain species of trees were proof against the attacks of fungi which were fatal to other species. It would be easy to give many examples of the deleterious effects of fungi upon trees, and vegetation in general, and which were either the cause or effect of disease and decay, and all the varieties of "rot" which played such havoc amongst trees in a living state, as well as when they were converted into timber. Whenever fungoid life found a suitable pabulum, there it would fasten itself, and under favourable atmospheric conditions it would quickly spring into vigorous action, and speedily consume the substance it lived upon. When vegetable matter arrived at a stage of thorough decomposition, it in general furnished a safe and valuable manure for the growth of other plants, without any risk of producing fungi deleterious to vegetation. Of many different species of ferns, lichens, mosses, and other cryptogamic plants which infested trees he had no time to speak, but as few or none of them were true parasitical plants, like fungi, there was less occasion to refer to them. Where such growths abounded upon forest trees they were generally caused by peculiarities of soil or atmosphere, such as cool dampish soil, and a close moist atmosphere, both conditions being highly favourable to the growth of cryptogamic plants. In the case of forest trees infested by them, drainage and judicious thinning, and exposure to air and light, were generally found to be the best preventive. In conclusion he recommended a thorough preparation of the ground before planting, and the removal of all dead or decaying wood likely to produce fungus, with careful attention to drainage, and timely and judicious pruning and thinning, as the best means of preventing the attacks of cryptogams on forest trees. When the trees were once attacked, especially by fungoid cryptogams, the best and safest plan was to root them out and burn them at once, to prevent the disease spreading to other healthy trees.

In the discussion which followed, Mr. France expressed the opinion that the trees attacked by fungi were not healthy plants. Dr. Brown was also of opinion that the trees attacked were in a weakly state. Mr. M'Corquodale corroborated Mr. Dunn's remarks, and mentioned instances which had come under his own observation of the destruction of young Scots fir, and other forest trees, from the fungi generated by the roots left in the ground

from a previous crop of timber. Sir Robert Christison, while of opinion that unsound trees were more likely to be attacked, thought there were cases where healthy trees were also seized by fungi. The thanks of the society were awarded to Mr. Dunn for his paper.

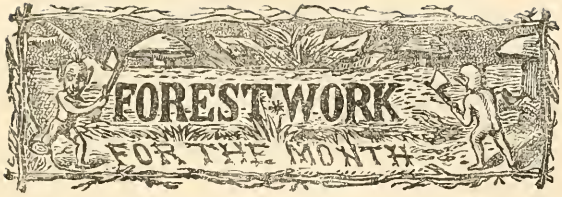
Subjects for Discussion at Next Meeting.

It was resolved, on the proposal of Dr. Brown, that one of the subjects for discussion at next annual meeting should be the Course of Study which should be followed by Students of Forestry belonging to this country, and the best arrangements for students at foreign schools seeing as much as possible of the Woods and Forests in Scotland. Sir Robert Christison suggested, as the second topic, the Rapidity of the Growth of Trees, and referred to the ignorance that prevailed in this department of forestry. He considered that measurements should be taken at two, three, four, and five feet from the roots. These subjects were approved.

Arboricultural Excursions.

It was resolved that the Arboricultural Excursion should take place in August next year, and that the spots to be visited should be Athol and Scone, in Perthshire. An excellent collection of specimens of British Woods was exhibited by Mr. Duff, Forester, Bayham Abbey, Kent, and a neat model of a Summer-house, by James Scrymgeour, Assistant Forester, Hopetown, Linlithgowshire.

Some routine business was thereafter transacted, and in the evening the members dined together, Mr. M'Corquodale and Bailie Methven, Croupiers.



ENGLAND.

In recommending the felling and stripping of birch, beech, Spanish chestnut, and alder, towards the end of November, my remarks were based upon the superiority of the wood when so treated, and not upon any useful purpose to which the bark can be applied, as we have no market here for anything except oak bark. Where the trees are sold by measure the bark will of course be included. Since the issue of the November number of the *Journal of Forestry*, in which is recommended, as the result of much experience, the felling of ash before the end of January, my attention has been directed to the following remark by a royal forester—Robert Monteath—which was published in 1831 :—"The ash should always be felled from after the 15th of November till the last week in January, and never before nor after that time, to have good timber, and to do it justice; nor is it at all easy to season ash timber properly when cut down at any other season than the above."

Weather permitting, planting may be continued until the middle of the month; but treading of the soil around plants should now be avoided. To secure them from frost, and as a protection against wind, heap a little extra soil around them, and allow it to settle down gradually. At this season of the year great risk attends the removal of plants which have been standing thickly in nurseries. Finish digging holes for spring planting that the soil may become well pulverized. By a timely exposure many of its insoluble substances, such as carbonate of lime, are changed and rendered soluble; the formation of ammonia and nitric acid is facilitated, and all vegetable matters are rapidly decomposed.

Considerable progress should now be made in falling coppice or underwood; and the produce should be removed or gathered along the sides of clearance roads. Here it is customary to shave hop-poles soon after cutting, and to stripe or notch, and cover up use-poles.

When not too wet, dig young plantations, especially of birch, cutting off two years transplants which are not making satisfactory progress. Ordinary soils may be well and carefully dug at 3d. per

square perch. In falling birch underwood, where the stools are getting old and scattered, leave a few of the most vigorous poles as stores; these, by shedding their seed, will help to fill up vacancies.

Now is the best time to fall elm, poplar, lime, and plane or sycamore. In out-of-the-way places where permission to bark a few of these trees standing has been obtained in April, they may be fallen this month, and immediately converted and used; and if the bark has not been stripped off quite close to the ground the stool may still retain its vitality. The lime and plane, when required for the manufacture of whitewood articles, should be sawn up and stored in a dry airy situation at once. Poplar stripped the spring before falling is useful in situations of exposure, as its shrinkage is small.

Though the conversion of timber is not usually one of the forester's avocations, yet his experience of its durability as paling, when it is cleft in the direction of its medullary rays, will enable him to give sound advice to those employed in the saw-lodge. Undoubtedly the best mode of sawing up a tree is first to quarter it, and afterwards cut out the boards so that their surface shall be parallel to the laminæ of the silver grain of the wood, which thus become coated with hard plates in the line of the medullary rays.

Dig or otherwise clean neglected hedgerows. In planting new hedges select three years' plants which have been two years transplanted, and cut off at three or four inches from the ground. Place them in a double line, giving them a triangular position at distances of eight or nine inches. Where the soil is tolerably light and porous, plant on the level, and work in an admixture of good loam and road scrapings. The addition of a little lime or superphosphate will also be highly beneficial. As the hawthorn requires a moderately dry soil in wet situations it should either be placed upon a mound, or have a covered drain or open ditch near it. It does not flourish upon very light, sandy, gravelly, or mossy soils, unless it is put in with a strong admixture of clay. Here it will also be advantageous to mix it with beech in the proportion of two or three of the latter to one of the former. These, however, must not be cut over like the quicksets at the time of planting.

Trim back all hedges which have been planted two years, allowing several inches of new growth to remain. If the fence is to be kept in a flourishing condition it should be narrowest at the top, and be quite free from weeds, so as to permit a free circulation of air around its base. Where the plantation hedges adjoin arable land, all cutting back beyond the ordinary trimming should be done when the fields are under corn crops.

Under dense shade, where hawthorn will not grow, and even beech would languish, plant holly, and give it a liberal allowance of good

leaf-mould. Afterwards cut back freely, and do not allow water to stagnate near it. Brush hedges upwards with a very keen bill. The switching bill is preferable to the shears.

Where old trees are considered worth preserving, remove all dead branches, and open out a trench all round them, cutting away the ends of the larger roots, laying drains to carry off water, and afterwards fill up with rich compost. Also remove the turf around the stems, loosen the soil, and mulch with the same compost.

A comparison of the prices obtained for the various lots of underwood, aided by a close observation of the species which have flourished or failed in the plantation, will now enable the forester to arrive at some decision as to the desirability of filling up or entirely replanting certain of the poorest quarters.

Pluckley, Kent. A. J. Burrows.

SCOTLAND.

December being one of the best months in the year for felling timber, no time should be lost in setting about that duty, if not already commenced. Those foresters who have to supply a home sawmill with all kinds of wood for buildings, fencings, cartmaking, and other purposes, should find out what particular kinds are likely to be required during the year and regulate their cutting accordingly. As a rule, no wood should lie in the uncut state longer than a year, for if it does so it not only loses in quality, but in some instances is attacked by an insidious fungus which generates premature decay. Every woodyard, therefore, should get a complete overhaul once a year, so as to keep a supply of fresh serviceable timber always in stock, and to have it well seasoned and in the best state for use when wanted. It is of great importance when carting in the wood not only to keep the different kinds of trees together, but, also as far as possible, to lay the different sizes by themselves, by so-doing the saw-miller can put his hand at once on what is wanted, instead of searching perhaps for a single tree throughout a large pile of wood that has been thrown indiscriminately together. Great care should also be taken to keep the wood clean, both in lifting it in the forest and also keeping it well up from the ground by means of bearers in the yard, because, when cutting it up a hundred revolutions of the saw in a dirty tree will do it far more damage than three hours' work in clean wood. This work has been rendered all the more difficult, from the almost incessant rain which has fallen throughout the country, and in all probability the carting of timber will have to lie over until dry or frosty weather sets in.

The felling of timber for sales should also be carried on with vigour. If the trees are more than eighteen inches in diameter, and cut with the axe, the men should work in fours, as this arrangement is found to be the most profitable in the long run. Every tree, as it falls, should be dissected and made ready for lotting, by so doing you keep the men's feet clear, and the work goes on with more expedition. When arranging the wood for sale avoid as much as possible long distances between the lots, for if the buyers are tired out by an unnecessary long journey, it is almost certain the competition will fall off. As a rule, every forester will make it his business to learn beforehand the different classes of buyers likely to attend the sale, and he should make it a point to have something for everybody, both as regards the kinds of wood, as well as the size of the lots. It is only by so doing that any degree of spirited bidding and popularity can be secured for a sale.

Along with this heavy timber cutting it will be necessary also to lay in a quantity of faggotwood, where such is required for the "big-house." The brush of the elm and beech is very suitable for this purpose when mixed up with that of young suckers, which are very plentiful on every estate. Pine or firwood of any kind is objectionable, owing to its liability to spark. Cut as much of this stuff as will last throughout the year, so as to make sure of having a good supply of dry kindling always on hand.

Foresters in charge of sawmills driven by water-power, should take advantage of the winter months in getting sawing operations well forward. No estate should be without an open shed where cut wood can be stored up to dry. There should also be a simple appliance for charring and tarring gate and paling posts as a means of protecting them from decay, and which could be done in rough weather when the men are shut out from their regular work. If time can be spared, the leaves should be raked off the plantation drives. They will be found to have drifted into large heaps by the late gales, and will have a most injurious effect upon the grass if allowed to lie and rot over the winter.

Dalkeith Park. ROBERT BAXTER.

IRELAND.

No time should now be lost in planting forest trees. The present season has been a very late one, so much so, that many of our oaks and elms are as green as they were at midsummer, but the wood is perfectly ripe, and they will receive no hurt by being immediately removed to their final situations. In removing the plants the forester ought to guard against exposing the roots to either sun, wind, or frost.

We are most particular on this point, and always rewarded with very few failures in our planting. No tree pays equal to larch; it succeeds well here, is a rapid grower, its first thinnings bring a good price, and being comparatively free from disease it should be more extensively planted.

Transplanting operations should now be deferred, unless on very dry ground, until spring, when the weather will be more genial, and the ground less soddened with rain for the roots to strike in; but if found necessary to remove a tree or shrub to admit of improvement or alterations being carried on, it should be planted in dry friable earth.

Many of our plantations being game covert, and as woodcock and pheasant shooting will be chiefly over early in the month, much should be done, in cutting and clearing where required. Heading down is extremely prevalent among amateurs, but the practice has a pernicious effect on the under cover. When improving the under cover, cut as close to the ground as can conveniently be done, as when such is the case, the suckers receiving their nourishment from the parent root rise more vigorous, and altogether make a superior cover.

All alterations and extensions in the pleasure-ground should now be carried on. During hard frost or snow cut and remove any trees intended to be dispensed with on the lawn or in the park. Continue felling heavy timber and disposing of the firewood delay.

In the nursery, lift and plant in line all layers, at the same time layer for a succession of plants. Dig roughly over all ground from which plants has already been removed. Nursery ground cannot be too much aërated and pulverized. Continue laying plants during fine weather, but on no account plant in wet weather. Gather all sorts of Coniferæ cones, and keep them in a dry, well-aired loft, perfectly secure from mould or damp. Collect softer seeds from ornamental trees and shrubs, dry them, and lay past carefully. On the farm, plash hedges, and plant new ones. Screen gravel and repair roads. Finish draining as soon as possible, not to delay spring ploughing, and keep all fences in good repair.

Ballinacourte, Tipperary. D. Sym Scott.

WALES.

Although the past month has been very wet, the open and mild weather has been most favourable for planting operations on upland and dry ground. Continue fencing, draining, clearing and preparing ground, and planting as recommended last month, according to the stat of the weather. In planting thin or mountain land, and exposed

situations, we prefer small well-rooted plants to large ones; they are not only less expensive, but are easier and more expeditiously planted, are not tossed about by the wind, and have a much better chance to take root at once, and make more vigorous growth the first year. Small plants are less liable to die after transplanting than large ones; and even when large ones succeed, they seldom make such vigorous growth during the first two or three years as small ones, especially on poor or exposed ground.

Continue the thinning of plantations and cutting of underwood; the latter may either be put into heaps, or laid in rows for the convenience of binding into fagots, or for whatever purpose it may be desired. Where the thinnings are of small size they may be carried to the drives, or outside of the plantations at once; but when of a larger size, horse labour should be employed to remove them during dry or frosty weather.

Cut down and dispose of all sorts of hedgerow trees (oaks excepted); it is well to have such trees removed before farmers commence operations preparatory for spring sowing. Both hedgerow timber and thinnings should, if possible, be removed while the ground is firm, or during frost.

Now that the leaves are pretty well all fallen, and especially where plantations have been newly thinned, see that all drains and ditches are properly cleaned out, as during the past very wet weather they have, in many instances, been taxed to their utmost, even where kept in thorough working order.

Look round plantation fences, and keep them in good repair, as during winter stock are apt to push their way into the woods in search of both food and shelter.

Keep roads, walks, and pleasure-grounds clean by raking, sweeping, and removing leaves, &c., and rolling during dry weather. Repair roads and drives, where necessary, with stones and gravel.

Where crops have been removed from the nursery, trench the ground well up, so as to receive the benefit of the winter's frost, &c., and collect and cart leaves to the compost heap.

LEWIS BAYNE.

Kinmel Park.

[*Correspondents sending letters signed with initials or fictitious names are requested to enclose their name and address, as otherwise their communications cannot be inserted.*]

AXE HANDLES.

SIR,—I have been not a little interested in the correspondence between Messrs. King and Kay about the axe head and mode of shafting it. I see that Mr. King gives such explanations at page 474 as make his illustration No. 3 a little clearer, but I must say that my experience is in favour of Mr. Kay's mode of shafting—having the reed of the handle in line with the edge of the blade, and the wedge inserted in line with both; also I prefer the bent handle to the straight one, if the tree is to be laid in for the saw, as the operator can level his hand better with it.

JAMES CRAIG.

Weston, Shifnal, Salop, 12*th Nov.*, 1877.

SIR,—Every man's opinion is his own peculiar privilege, although to others its worth may be scarcely equivalent to the cost of the paper upon which he indites it. However, before we assert and confidently insist on any particular implement being superior to all others, we ought first to give each a practical test under unbiassed circumstances, to see wherein it excels or fails. Having been a bit of an observant traveller, I have come across woodmen ever ready with their own views of such tools, and I have no doubt such would smile at Mr. Gladstone's name being mixed up with chopping timber. Without waiting for drawings of "softwood" axes, I will here state that I can see no reason why there should be any difference in the *shape* of felling axes, unless to please mere fancy, and fancy is no criterion. With reference to the breaking of handles, I never found a skilled workman smash his shaft; on the contrary, I have known a shaft made out of a common Scots fir slab last a year, constantly at work, without breaking.

D. SYM SCOTT.

Ballinacourte, Tipperary.

FELLING TIMBER.

SIR,—As the *Journal of Forestry and Estates Management* advocates a free discussion on all subjects connected with its profession, kindly allow me to offer a few remarks on timber felling, and the kind of axes which I find to be the most suitable for the work. In the first place, I must differ from the rule laid by your talented contributor J. C. K., that the best way to fell a large tree is to saw it down, and also that by saw felling a tree a considerable amount of timber must be lost, as it is an impossibility to get the saw-cut sufficiently low in the majority of cases, but that a certain amount of the best timber in the tree must be lost. Also, again, by saw felling a tree all defects are seen at once, such as ring shake, or stright shake, or open-hearted, or slight decay, which by proper axe felling would be less liable to be detected; as every timber merchant when selling timber in the round wishes to give it the best appearance, and obtain for it the best price possible, so the landed proprietor is perfectly justified in doing the same. Now as to axe-felling a tree. We will take for an example a large ash. 1st. Let the feller with his mattock stock clean away all soil from round the stem, until he gets well down on the spurns, and then with his broad heavy Herefordshire axe dress the spurns off perfectly level and in octagon fashion with the butt of the tree. He must then keep descending until he gets as near as possible to the terminus of the timber under the heart of the tree, so that when the tree is felled, it should in the majority of cases draw the soil under the heart of the tree. If this is properly done, very little turning out of the butt end will be required when the tree is down, and the less chips taken off the heart the better. Crippling or cutting the large arms, so that they will break with the fall and not split the timber or burst the tree, is always necessary in felling large timber.

Now your readers will observe that this plan entails much more work than by simply sawing the tree down, but I contend that if work is worth doing at all, it is worth doing well, and by following this plan there is no unsightly root-end left standing above the ground, and the hole where the tree has stood is soon levelled over, and gives satisfaction to everybody.

Now a word or two as to the best axe, for felling timber, hard or soft wooded, or both combined. The best broad axe used for felling and dressing the spurns, and turning out hardwood, and also for felling and turning out soft wood, is what is called in the Midlands the "Herefordshire axe." I may also add that the best men I have found to use them well are the genuine Herefordshire timber fellers. The size and usual weight is as follows:—Length from back of axe head to cutting edge 11 inches; width at cutting part $6\frac{3}{4}$ inches; width across the eye 4 inches; thickness at axe head $1\frac{1}{2}$ inches, which tapers gradually down to the cutting edge; shaft 3 feet 3 inches long; total weight 10 lbs.

The narrow axe, which is only used for cutting a drift under large timber trees, is as follows:—Length 12 inches; width $3\frac{3}{4}$ inches; thick-

ness at axe head $1\frac{1}{2}$ inches, which gradually tapers down to the cutting edge ; shaft 3 feet 3 inches long ; total weight $7\frac{1}{2}$ lbs.

In conclusion allow me to say that these axes should be well wedged into the shaft with a good iron wedge, placed not across, but *lengthways* of the eye. The length of the eye is $3\frac{1}{2}$ inches, by rather more than an inch in the widest part, and ought always to be made as large as possible, as it is at the eye that all shafts generally break.

Hawkstone, Salop. R. JANDRELL.

THE PINE BEETLE.

SIR,—In reference to the letter at page 501, from Mr. Scott, Southwick Park, upon the pine beetle in Hampshire, I may state that while upon the Lennoxlove Estate in East Lothian, between the years 1838 and 1841, eight or ten acres of an old Scotch fir plantation were cut down annually, the ground drained and replanted, chiefly with larch, spruce, and Scotch fir, the former of which were soon attacked by the beetle.

We set to work and traced them to some old wood lying upon the ground, where we found them in all the different stages from the larva to the full-grown beetle, and where I have no doubt they lived and carried on their operations the previous winter, and would do so again in the same way had the old wood been allowed to remain ; but we cleared it all away, burning the decayed portion, and in this way we soon got rid of the insects ; but before this was done they had destroyed a considerable number of trees, chiefly larch, newly planted. Boys were also employed to collect and destroy the full-grown beetles. Mr. Balden, the intelligent forester, wrote an essay upon the subject, for which he obtained a gold medal from the Highland and Agricultural Society. I may mention that I have only seen one tree affected here during the last twenty-six years.

JOHN MCLAREN,

Hopetoun, 8th November, 1877. *Forester.*

SIR,—In the last issue of the Journal Mr. Scott makes reference to this insect, and believes it is propagated in the dead or wasting branches of the pine itself. It is a pity he did not mention as minutely as possible how many stages he found them in, as well as the different sizes and colours. I know a good many deeply interested parties who do not believe in this manner of propagation ; I am also rather sceptical. It is generally believed [by none but the ignorant—*Ed.*] that the aphis or larch bug is propagated by the natural sap in its ascent being suddenly checked and caused to stagnate in the plant by a lengthened period of hoar-frost in early spring, or at least after the sap has commenced to ascend the trunk of the tree or plant. And why may it not be the cause of the *piniperda's* propagation also? Possibly some entomologist may help to clear up this

matter of propagation, for if the cause mentioned by Mr. Scott is the only one, more care must be given to our woodlands ; and not only all branches, but also the chips made by the axe in the act of felling or pruning off the boughs must all be burned as soon as possible. All dying trees must also be cut down at once, as I believe if this system of propagation is correct, in the case of the pine, it will also be found to be the case with all the other classes of trees ; consequently a thorough clearance of all waste produce will be necessary as soon as a course of thinning is completed ; and if actually found to be the case, the sooner it is universally adopted the better, if our employers will afford the time and means necessary for its accomplishment. But this beetle, though injurious by retarding the growth, and the means of deforming the tree when it attains a medium size, does not cause the plant to die [it does—*Ed.*], and possibly the better course would be, as I already suggested in a former communication, to get a couple of boys to go over our young plantations, and with an averuncator cut off all the young twigs they can find attacked by the beetle, carefully gathering and burning them. But if the counteraction of the sap is the cause, nature alone can prevent their propagation. [The "counteraction of the sap," whatever our correspondent may mean by that phrase, has nothing to do with the propagation of the pine beetle.—*Ed.*]

NOTIONAL.

FOREST SCHOOLS AND THE EDINBURGH ARBORETUM.

SIR,—I have had my attention called to an article in the *Indian Forester* for last July, in which some entirely erroneous remarks are made by B. H. B. P. upon my proposal to establish forest schools in Britain, more particularly in Edinburgh, in connection with the new Arboretum there. B. H. B. P., is not the first person who has stated that a British education is insufficient for the training of officers for the forest service in India,—see my pamphlet on the "Schools of Forestry in Europe," pages 56 to 59, where I give the opinion of his chief, Dr. Brandis, upon the subject, in which exactly the same arguments are advanced. B. H. B. P. admits all I have ever claimed for the Arboretum when he says that "an *Arboretum*, giving a valuable insight into the form, natural history, and so forth, of a variety of species, as well as an opportunity for studying methods of planting, pruning, and treatment, might be valuable as an *arboriculture* school ;" and nowhere have I given occasion for his ridiculous suggestion, to "imagine the professor setting the pupils to treat the *Arboretum* the first year as forest of a 'coppice under standards!' and then perhaps the succeeding classes would draw up a working plan based on the principle of conversion back into high forest!" Also, I have never anywhere said that "the establishment of such a school would save pupils the *disadvantage* of learning French or German" (!)—the italics are B. H. B. P.'s.

What I have said in my pamphlet was in view of the education of foresters generally, and is as follows :—"I have before me the *Programme de l'enseignement à L'Ecole Forestière* at Nancy, and the official report of the prescribed studies in the *Central-forstlehr-Anstalt*, at Aschaffenburg, and I am more or less acquainted generally with the courses of study followed at most of the other Schools of Forestry in Europe ; and I consider that some such course of study as the following would be equivalent for the purposes of our countrymen to that followed in any one of these valuable institutions, with the advantage of not requiring the acquisition of a foreign language, which few of our foresters and sons of foresters have facilities for effecting, or at least of effecting to such an extent as to enable them to understand instructions as thoroughly as they would instructions given in their own tongue ; and seeing that in our colonies, and in our Indian Empire, evils which have existed long are being experienced and remedied, and those whom the country would engage to go forth to meet the evils must go, at the country's expense, to acquire the necessary education in other lands, and in a foreign language, unknown to most young gardeners and foresters, and sons of foresters, whose lives have been spent in connection with the management of trees, and which is so taught in many of our schools that few even of the young men of our country who have had a liberal education could understand instruction given in it as they could instruction given in their own tongue."

I have also fully recognised in my pamphlet (pages 64 and 65) the treasures of literature on forest science in the French and German languages, as well as in the languages spoken by most of the other European states, and I certainly consider the ability to *read* those languages a decided acquisition to a forester.

I do not know how I could have expressed myself clearer on "the difference between ARBORICULTURE and SYLVICULTURE," of which B. H. B. P. makes so much. What I have said is that, "while our French neighbours speak of *Sylviculture*, the culture of woods, we speak of *Arboriculture*, the culture of trees. While they, in speaking of *Les Forêts* and of *La Code Forestière*, refer to a country covered more or less with trees, we, in speaking of *The Greenwood* and of *Forestry*, hitherto have thought chiefly of the game and of the chase, or of the shooting of deer. Our forest laws relate mainly, if I may not say exclusively, to hunting, these laws having nothing to do with shrubs and trees, excepting in so far as they may supply shelter or covert for game. I speak advisedly when I say that, according to the technical use of the term in English law, a forest need not contain a single tree, and a dozen of contiguous counties might be covered with trees without these constituting a forest."

It is a well-known fact, which B. H. B. P. admits, that British arboriculture is decidedly superior to anything of the kind to be met with on the continent of Europe or elsewhere ; and by the establishment of British Forest Schools I wish to meet the want he describes as felt by English taught foresters when first they arrive in India, viz., "the need of a

sylvicultural training," in addition to a knowledge of arboriculture It is quite absurd of him to say that sylviculture and "kindred subjects *can* only be taught in countries where forests exist on a large scale." At Frieburg it is the opinion of the forest officers and forest students that the scientific studies should be conducted at a university. The students at the forest schools in France, Russia, Finland, Bavaria, &c., are taken for practical training to forests at great distances from the schools, a method of the easiest application in our own country, where the numerous means of communication are so cheap, speedy, and convenient.

The allusions I have made in my pamphlet to the requirements of the Indian forest service are but few; but by others of the highest authority whose opinions I have quoted, including Dr. Hooker, Dr. Balfour, Sir Robert Christison, Bart., Dr. James Brown, &c., the provisions made for it are spoken of as disparaging to our country. I have so far as possible vindicated the former neglect of such an important subject by our country, because of the totally different circumstances in which we are placed from other countries in regard to the requirements of forest products, which accounts for the difference in the attention hitherto given in Britain to what is known in the Continental states as Forest Science. I have given *in extenso*, at pages 59 to 62 of my pamphlet, the practical suggestions of Dr. James Brown to meet all the requirements in teaching the science and practice of forestry not met by an arboretum.

Haddington, 5th November, 1877. JOHN CROUMBIE BROWN, LL.D.

FIXING GATE AND FENCE POSTS.

SIR,—Believing that we have heard probably all that is worth hearing for the present on the "Preservation of Posts," foresters should now lay aside their theorizing and adopt practice—experimenting with one or other of the various methods adduced, so as to enable them to record at some future date, for our enlightenment, the results of any such test. Next to "preserving" in order, and in the interest of foresters and farmers, stands the fixing of posts in the ground, so as to secure strength for resistance and durability of tear and wear. The whole secret of hanging gates is to fix the post to prevent swagging. The plan I have followed for some years has given entire satisfaction. Taking a straining post, I dig a hole lengthways (not across) the fence, having the one end about eighteen inches deeper than the body of the hole. In the deepest end I fix a flat stone in the solid ground for a heel, and perpendicular to this I place a shoulder-stone near the surface; the post is then placed in position. A large stone is next slipped down in front, and then a key-stone is jammed home between the front stone and the post with the head of a crowbar. Earth is then tamped firm all round until the hole is filled to a perfect level. When this is done, a large stone is placed against the far end of the hole, and the space between this stone and the post is filled up with flat stones

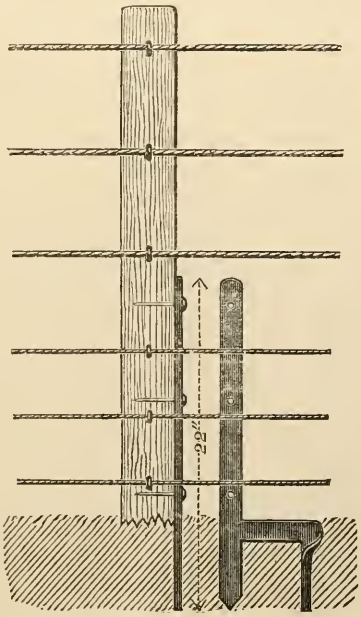
set on edge; a key is then driven down close to the post. Stones are packed all round, and the post is fixed. One point has to be observed: the stones act as a horizontal stay, and must be placed to resist the strain Having put the utmost test on this method of fixing strainers with a No. 3 wire, I never found them "give." I fix up my gate-posts in a similar way; only when they are not straining posts I place the stones of the hanging post on the side next the gate, and make sure the stones are well wedged up on the opening side. I have erected wire fences, with every post fixed with stone, at a cost of something less than a penny per yard. I am fully persuaded if posts were seasoned, charred, and tarred, as previously recommended, and erected with stones as described, it would prove the best preventative of rot yet found out.

D. Sym Scott.

Ballinacourte, Tipperary.

PRESERVING OF WOOD POSTS.

Sir,—We have read with pleasure the discussion in your Journal on the preservation of fencing posts, and as some of your correspondents are desirous of knowing what sort of iron prong Mr. Baxter advocates, we have pleasure in sending you a sketch of the same, and ask your kind permission to insert it in your next issue for their information. Those which we supplied to Mr. Baxter for his Grace the Duke of Buccleugh



were made with a single prong as shown on sketch; the three holes in the standard were countersunk on both sides, so that the prong may be fixed

on either side of the "stob" as circumstances may require. They were $1\frac{1}{4}$ in. × $\frac{5}{16}$ in. thick and 22 in. long over all, and cost $6\frac{3}{4}$d. each. The iron market being now much easier, they might be made for a little less From the extensive experience we have had in fencing, we consider Mr. Baxter's idea a good one, and indeed it must be clear to every one that a saving can be effected by nailing these prongs on to an old "stob," and thus making it do service for other ten years at least. Besides, by his method it is unnecessary to draw the staples, in the case of a wire fence, or to knock off any of the rails, in the case of a wooden fence, the prongs merely requiring to be driven down alongside and nailed to the "stob."

For light soils, triangular-shaped standards can be used alternately with the prong standards, so as to give the fence greater stability.

A. & J. Main & Co.

25, *George IV. Bridge, Edinburgh.*

SPRUCE TIMBER.

Sir,—In reference to the durability of spruce timber, allow me to say that I know of spruce boarding used for sarking in byres thirty years ago, which is now to all appearance as sound as when it was used. A part of the same tree was used in a similar construction, and is now quite rotten. In both cases white pine was used along with the spruce, and when lately examined showed in both cases no comparative difference as regarded either rottenness or soundness against that of the spruce; consequently age, class of soil, whether grown in lowlands or highlands, made no difference in this case, seeing it was all the one tree, and therefore I trust I may be excused if I attribute the different state of preservation to good ventilation in the one case and bad ventilation in the other, as I fancy the boards would be equally well seasoned to begin with.

What I believe to be the chief cause of the low estimate generally formed of spruce timber is that it is not easily dressed, consequently used for rough purposes where dressing is not required; and often for rough or temporary sheds, under the shade and drip of trees or surrounding buildings, in badly ventilated situations, where neither it, nor any other class of foreign wood would stand long without becoming decayed. And before spruce timber can get the definition properly applied to it, as that given by Mr. Baxter and some others, we must see it tested and compared with various other classes of home-grown timber, no less than foreign wood; and if thus applied in the same buildings, and for the same purposes, its qualities would become fully known; and I guess after being thus fully tested, when equally well seasoned, a higher estimate would be formed regarding it, and consequently more demand.

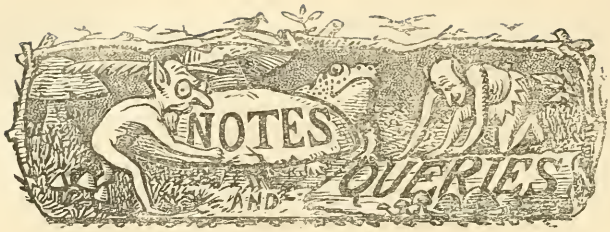
Thomas Wilkie, *Forester.*

Ardkinglas, Inverary, 6th November, 1877.

LARCH FENCING POSTS.

SIR,—In seeking to increase the amount of information upon the durability of larch posts when properly cared for, I may mention the following case as having been duly witnessed by the writer:—A farmer purchased several thousand larch stobs, which were to be all squared to three and a half inches. He got them home in autumn, and he at once stripped off any bark left upon them, carefully placed them in a dry and airy shed, open at one end and front. In April he lit a fire in front of the shed, and then charred eighteen inches of the point of all the stobs in the front row of piles, these being the nearest to hand and best seasoned. A large boiler full of coal tar was boiling at one end of the fire, into which he steeped the charred ends for a few minutes, afterwards carefully handling them till dry, when they were immediately despatched to their destination, and driven in line of fence for carrying wires. After being twenty years in use not one out of twenty has been replaced, and consequently (except the five per cent. mentioned), have, as yet, no need of Mr. Baxter's novel iron-pronged supports.

SEMPER PRO AMICO.



[*The Editor requests the assistance of Readers in answering Queries, so that the usefulness of this Department may be maintained.*]

Bitter Willow.—It is not correct to say that the bitter willow is never eaten by stock, but they do not relish it when other food is to be had. It can be made strong enough to resist the pressure of heavy cattle, by planting strong stakes of five or six feet in length in an oblique position, each crossing three or four others, forming a diamond or lattice fence. Stakes of bitter willow, of this size, which could be bought four years ago at 60s. per 1,000, cannot now be had for twice that amount. For many years past willows have steadily advanced in price, but more especially the bitter willow since its importance as a medicinal plant has been fully established. At present, therefore, to make a strong bitter willow hedge would be an expensive operation, and for general purposes impracticable.—W. Scaling.

In reply to Subscriber, page 509.—The bitter willow is quite eligible as a hedge plant, also useful as a basket willow, but better when peeled for that purpose. Sheep and cattle do not eat it readily, hares and rabbits will not touch it unless hard pressed by hunger, but it would not be a satisfactory fence against heavy stock.—D.

Composition for Preserving Trees from Hares and Rabbits.—In reply to the inquiry of A. B. in your October issue (p. 440), we may mention that we have for several years used "Lightfoot's Patent Lubricating Oil," No. 3, which we have found successful, and it does not injure the trees in the least. It has the strong paraffine smell, but is a thick green-coloured oil. We also use the same oil for destroying the "American blight," on fruit trees.—Cheal and Sons, *Lowfield Nurseries, Crawley, Sussex.*

Oak Galls.—I herewith send a small box containing an oak gall and a fly which I cut out of it. Can you or any of the readers of the Journal say what is the name of these flies? [*Cynips querci—Ed.*] also whether such flies are injurious to the oak or other trees, or if they are the cause of these galls growing on the trees, and how the egg or larva is deposited in the centre of each? Their sole use, if I may use the expression, seems

to be to rear these flies. The trees on which I find them growing are not in a healthy state. I cut a cluster of galls off a tree in their green state in the month of June last, and after cutting one through I could see, with the aid of a microscope, a clear speck (the egg ?) ; I kept some of them to see what they would turn to, and lately cut the fly sent out of one of them.—J. Craig.

Bark.—In former years the bark of sweet chestnut could be sold to the tanners in this neighbourhood along with that of the oak, but now they will not have it. The bark of birch and alder sells readily in Scotland, but we have no market for it here. Can any of your readers inform us where a ready and remunerative market can be found for such produce ?—D. Tait, *Owston Park, Doncaster.*

Willows and Spontaneous Combustion.—Can any of the readers of the Journal of Forestry explain the statement made in "*English Forests and Forest Trees*" that the willow is liable to spontaneous combustion ? It is stated at page 56 of that work, that such a phenomenon occurred in 1846 on the banks of the Cam, amongst some fine willows in the full vigour of robust health, which suddenly burst into ignition and poured forth clouds of smoke, till they were burnt like tinder to their very core ! Has anyone seen this phenomenon of late years ?—Calt.

Barking Irons.—I will feel obliged if you, or some of your experienced readers, will inform me where the *best* description of *barking irons or tools* can be purchased ? I have some difficulty in getting them made, and I would be glad to know if they can be bought of good make and quality.—D. M., *Ross-shire.*

Osiers.—H. S. who made an enquiry on this subject in the October number, will find an answer on page 556.—[*Ed.* .]

Select Plants Eligible for Culture in Victoria. By Baron Fred. von Mueller. McCarron, Bird, and Co., Melbourne.

In the volume before us, which is only an extended catalogue of plants supposed or known to be suitable for naturalization and culture in the colony of Victoria, Baron Mueller describes in a concise way many plants that are but little known in the Northern Hemisphere, but which, as he says, may prove valuable in the genial climate of Victoria; and this work will be found very useful to colonists and their friends at home, or in other countries, as a book of ready reference when they wish to find out what is known about any plant cultivated or naturalized in the colony, and also about those which the author considers eligible for introduction to the Australian colonies. Baron Mueller has had much experience of Australian plants, and those best adapted for naturalization in Australia, and his opinion may be safely followed in reference thereto. He has bestowed much labour in the compilation of this work, and has included every plant in any way worthy of notice as likely to prove useful to the colonists, the aim being to bring together in close array some condensed notes in popular language from more voluminous works on all the principal utilitarian plants hitherto known to prosper in extra-tropic zones. We make the following extract of what the author says about some of the Gum Trees, in which so much interest is now taken in various parts of the world, owing to their wonderful rapidity of growth, usefulness of their timber, and their sanitary influence in malaria-infested districts:—

"*Eucalyptus globulus*, La Billardière, Blue Gum tree of Victoria and Tasmania.—This tree is of extremely rapid growth, and attains a height of 400 feet, furnishing a first-class wood; shipbuilders get keels of this timber 120 feet long; besides this, they use it extensively for planking and many other parts of the ship, and it is considered to be generally superior to American rock elm. A test of strength has been made between some blue gum, English oak, and Indian teak. The blue gum carried 14 lbs. weight more than the oak, and 17 lbs. 4 oz. more than the teak upon the square inch. Blue gum wood is also very extensively used by carpenters for all outdoor work, fence rails, railway sleepers—lasting about nine years,—shafts and spoke sof drays, and a variety of other purposes. *E. globulus* is hardier than either orange or lemon trees.

"*Eucalyptus sideroxylon.* The ordinary Ironbark Tree of Victoria and some parts of South Australia and New South Wales. — It

attains a height of 100 feet, and supplies a valuable timber, possessing great strength and hardness; it is much prized for its durability by carpenters, shipbuilders, &c. It is largely employed by waggon-builders for wheels, poles, &c.; by shipbuilders, for top-sides, treenails, rudder-stocks, belaying pins, and other purposes; it is also used by turners for rough work. It is very extensively employed for the handles of axes and other implements by Victorian manufacturers. It is much recommended for railway sleepers, and extensively used in underground mining. It is considered the strongest wood in our colony. As the supply of its very durable timber is falling short, and as it is for some purposes superior to that of almost any other *Eucalyptus*, the regular culture of this tree over wide areas should be encouraged, especially as it can be raised on stony ridges not readily available for ordinary husbandry. The wood is sometimes pale, and in other localities rather dark. The tree is generally restricted to the lower Silurian sandstone and slate formation, with ironstone and quartz. It is rich in kino. Next to *E. rostrata* it has thriven best about Lucknow, in India, among the species tried there for forest culture.

"*Eucalyptus marginata* (Smith), the Jarrah, or Mahogany tree of South-west Australia, famed for its indestructible wood, which is attacked by neither chelura, termites, nor teredo, and therefore so much sought after for jetties and other structures exposed to sea water; also for any underground work, and largely exported for railway sleepers. Vessels built of this timber have been enabled to do away with all copper plating. It is very strong, of a close grain, and a slightly oily and resinous nature; it works well, makes a fine finish, and is by shipbuilders here considered superior to either oak, teak, or indeed any other wood. The tree grows chiefly on ironstone ranges. At Melbourne it is not quick of growth, if compared to blue gum or to stringy bark (*E. obliqua*), but it is likely to grow with celerity on our ranges. Instances are on record of the stem having attained a girth of 60 feet at 6 feet from the ground, through the formation of buttresses.

"*Eucalyptus amygdalina*, La Billardière.—In our sheltered springy forest glens, attaining not rarely a height of over 400 feet, there forming a smooth stem and broad leaves; producing seedlings of a foliage different from the ordinary state, as it occurs in the more open country. This species represents the loftiest tree on British territory, and ranks next to the *Wellingtonia gigantea* in size anywhere on the globe. The wood is fissile, well adapted for shingles, rails, house-building, the keelson and planking of ships, and other purposes. Seedlings raised on rather barren ground near Melbourne have shown the same amazing rapidity of growth as those of *E. globulus*, yet, like *E. obliqua*, they are not so easily satisfied with any kind of soil. It has endured the frosts of the milder parts of England with *E. polanthemos* and *E. viminalis*. In New Zealand it has survived the cold where *E. globulus* has succumbed. *E. amygdalina urnigera*, *coccifera*, *rostrata*, and *corymbosa* have proved at Rome, according to the Rev. M. Gildas, more hardy than *E. globulus*, *diversicolor*, *resinifera*, *longifolia*, and *melliodora*. Professor Balfour states that *E. viminalis* has stood for thirty years

at Whittinghame, Haddingtonshire, Scotland, attaining a height of 50 feet, and a base of 8 feet in circumference; shelter against hard winds in these cases is imperative. The now well-known *Eucalyptus* oil is furnished in greater or smaller proportions by all the different species. It was first brought into notice by Mr. Bosistos, who has the credit of having ascertained many of the properties of the oil for technical application."

Our space will not permit of more extracts, although there are many very interesting notes concerning Australian trees and timber conveyed in a similar easy style, but we must refer our readers to the book itself for them. In another edition no doubt the author will take greater care to avoid small errors in the compilation, of which there is a good share even for a new work, which mar its composition to a certain extent, but do not detract from its value as a book of reference. We may add that the work is printed for the Government of Victoria, showing the great interest taken in such matters by some of our youngest colonies.

Botany. By J. D. Hooker, C.B., P.R.S. Third Edition. Macmillan and Co., London.

In this small volume of 130 pages Dr. Hooker sets forth in clear, simple, and easily-understood language the rudiments of the principal facts of plant life, with the object of training beginners to observe plants methodically and accurately, and to apply the knowledge thus obtained to the systematic study of botany. By its means the learner may acquire a sound elementary knowledge of the number, nature, relative positions, and uses of the principal organs of plants, of the order and way in which they grow and multiply, and of those resemblances which exist amongst them, by a comparison of which their true relationships are known and themselves classified. The student should possess a small pocket microscope, magnifying five or six times, a sharp penknife, and a pair of light forceps; aided by these he is able to study and investigate any botanical specimens that come within the compass of this useful elementary treatise, which is numerously illustrated with woodcuts of the principal parts of plants, and their distinctive characteristics and functions. The plants referred to in the book are generally easily procured either from woods, fields, or gardens, which is of much advantage to the beginner, who thereby soon learns to choose only the best specimens. A copious index of the common names of the plants referred to, completes this excellent manual.

Rockwork for Aquariums, &c.—Pieces of coke dipped in thin Portland cement, and joined together with the same material, make the lightest and best rockwork. It should be allowed to harden, and then covered with water (frequently changed) for a week or two.—*D.*

Sack Preserving.—A North German paper states that corn and other sacks may be effectually prevented from rotting, and otherwise made to do duty much longer than usual, by simply soaking them in a solution of oak-bark tan. The quantities recommended are 2 lbs. of tan in seventeen or eighteen pints of boiling water, the clear solution being strained off after it has stood an hour. In this the sacks should lie for twenty-four hours, and then be well washed in fresh water and carefully dried.

Paris Parks and Gardens.—The annual cost of keeping in order the trees, shrubberies, and seats upon the boulevards and in the public squares and gardens of Paris is nearly 2,000,000 fr. It is estimated, says the *Builder*, that the trees in the avenues and boulevards of Paris number 82,201; those in the cemeteries, 10,400; and those in the squares and courtyards of various buildings, 8.300. There are also 8,000 seats for the accommodation of the public. The expense of keeping up all the extra-mural recreation grounds, exclusive of the Bois de Boulogne and the Bois de Vincennes, is rather more than 300,000 fr.

British Oak (Quercus robur) in America.—On the 6th of August the writer measured a large number of oak growths, which were over four feet, and still growing. The variety was *Quercus robur*. The oak does not grow near as slow in America as many suppose. Mr. Hoopes, of West Chester, has one—a variety of *Quercus macrocarpa*—that is only twelve years old, and is now 17 feet high and 17 inches in circumference.—C. D.

A Handsome Prize.—The Government of India has renewed the offer of a reward for the best process or machine for separating the fibre of the *Böhmeria nivea*. The reward is fifty thousand rupees, and a smaller reward of ten thousand rupees will be given to the second best machine or process. The amount is well worth competing for, but persons desiring to do so must notify their intention befor the 31st December, 1878. The trials will be held at Sahranpore, in the North-West Provinces, in the months of August and September, 1879.

The Deciduous Cypress.—This tree is, where it flourishes, an object of much beauty. And for the information of those interested in such trees, I beg to say that there are two—and those the largest I ever saw of that variety—growing in the grounds here. The larger of the two stands about 100 feet high, and at four feet from the ground measures 7 feet 6 inches in circumference. The trunk is comparatively straight and clean for about forty feet, at which point it assumes two leaders, one of which was broken off some years ago with the wind, and from the same cause it is *minus* some of its branches,

otherwise it is a fine tree of its kind. It is growing in a light gravelly but wet soil within fifty yards of the river Avon, and on a level with its banks. The second and smaller tree is, I think, a good specimen of the deciduous cypress, and is growing almost in the centre of an angle formed by the confluence of the rivers Avon and Chalk, and within thirty-two yards of the latter and thirty-five yards of the former. It is about 45 feet high, with branches touching the ground, and 36 feet through. The trunk at four feet from the ground measures 4 feet 6 inches in circumference.—*H. W. Ward, Longford Castle, in "Gardeners' Chronicle."*

Railway Planting of Eucalyptus.—The Central Pacific Railroad Company are doing a good work in tree planting, having already planted 40,000 *Eucalyptus* trees along the line of their road. This enterprising company intend, according to the *American Naturalist*, planting certain species of the *Eucalyptus* on each side of their right of way through five hundred miles of the Californian valleys, and it is estimated that 800,000 trees will be required for this purpose.

How to apply Manure.—When planting trees, shrubs, and vines, no manure should be placed in contact with the roots, but put it above them when the holes are nearly filled, so that it will be covered several inches. Cow manure is best; well-rotted stable manure is almost equal; but as winter approaches, coarse manure, mixed with considerable straw, spread over the ground rather thick around the stems or trunks, as far as the roots extend, will be useful in preventing injury from severe frost, also enriching the ground and beuefiting the trees.—*Land and Water.*

The Rain Tree of Peru.—The Consul of the United States of Colombia, in the department of Lereto, Peru, writing frow Yurimagus, states that in the woods adjacent to the city of Moyobamba exists a tree called by the natives Tamai-caspi (rain-tree), which possesses some remarkable qualities. It is a tree of about fifty feet high when at maturity, and of about three feet in diameter at the base, and has the property of absorbing an immense quantity of humidity from the atmosphere, which it concentrates and subsequently pours forth from its leaves and branches in a shower, and in such abundance that in many cases the ground in its neighbourhood is converted into a perfect bog. It possesses this curious property in its greatest degree in the summer, precisely when the rivers are at their lowest and water most scarce; and the writer proposes that it should be planted in the more arid regions of Peru for the benefit of agriculturists.

A Venerable Wild Cherry.—The following dimensions of an old wild cherry tree, now in a decaying state at Gordon Castle, N.B., are given by Mr. Webster in the *Gardeners' Chronicle:*—Circumference of stem at surface of ground, 18 feet; at 3 feet up, 14 feet circumference; at 5 feet up, 14 feet circumference; circumference of spread of branches, 189 feet; and height of tree, 33 feet.

New Forest.—The Queen has been graciously pleased to appoint the Right Honourable George Sclater Booth, M.P., to be the official verderer of the New Forest.

Submerged Piles.—Among the numerous instances of the hardening of oak under water, Berthier mentions remains of bridge piles at Rouen, which were driven in 1150. They resembled ebony in texture and colour, and the change was attributed to peroxide of iron. M. Charil Marsaines, in destroying the remains of a dyke which was built by Vauban in 1681, found that the oak timbers had the same appearance. He did not examine them chemically, but

he quotes experiments of Buffon to account for the probable presence of an iron oxide.

Wood *v.* Cast iron.—Herr Hirn has been conducting a series of experiments in Germany on the comparative strength of wood and cast iron in their different applications, and finds that in a great number of cases the former has the advantage. Professor Hirn finds the strength of wood to be in direct ratio to its density, and this strength is increased by immersing the pieces of wood in linseed oil, heated from 185 degrees to 212 degrees Fahr., and letting the wood thus immersed remain for two or three days, or until partially saturated.

Japanese Birches.—Mr. Maule, of the Bristol Nurseries, has been good enough to send us for determination specimens of two Japanese Birches, which from their large (male) catkins and handsome appearance are worthy attention. One, an upright grower, with the young shoots brownish and dotted with resinous dots, with glabrous ovate leaves gradually tapering to a long point or acumen, with rather closely set prominent nerves, and irregularly serrated leaves, and with male catkins 2½ inches long, is, we believe, the *B. utilis* of Don, or rather that form of it which Regel calls *B. Bhujapaltra*, Wall., var. *subcordata*. We prefer to use the name *utilis* because it is the earlier name. and one not so uncouth to English ears. For garden purposes the varietal name, *B. subcordata*, would perhaps be the most convenient. The second is a weeping form, with the young shoots brownish, sprinkled with resinous dots. The young leaves are obliquely ovate-cordate, rather shortly acuminate, serrate, thinly beset with pale appressed hairs, especially along the nerves, and covered on the lower surface with small circular glandular scales. The male catkins are nearly three inches long. This second form we refer to *B. ulmifolia*, var. *costata*, which might for garden purposes be called simply *B. costata*.—*Gardeners' Chronicle.*

Californian Conifers.—We were at the height of about 5,000 feet above the sea, in the finest zone of the grandest conifers in the world. There were the Pitch Pine, or *Pinus ponderosa*, the Sugar Pine (*P. Lambertiana*), the White Cedar (*Libocedrus decurrens*), and the *Abies Douglasii*, the famous Douglas Fir, The Sugar Pine is remarkable for the size of its cones, which I have picked up more than sixteen inches in length, and which may be well described as hanging like ornamental tassels from the ends of the branches. The timber of this tree is said upon good authority to be the best in California, and its size gigantic, being not unfrequently 300 feet high, and from seven to ten feet in diameter—"*Over the Sea and Far Away,*" *by T. W. Hinchliff, M.A., F.R.G.S.*

Drought and Disafforestment.—Colonel Beddome, Conservator of Forests, remarks that the extreme drought of the last two years has told much upon the appearance of the ceded districts:—"I observed not a few trees (chiefly *Strychnos nux vomica*, *Memecylon tinctorium*, and *Dodonæ viscosa*) dead and dying from the drought; this has rarely, if ever, come under my observation before, certainly never to such an extent; it was very noticeable how green, fresh, and healthy all the Red Sanders appeared,—it is evidently a drought loving tree." It is worthy of remark that the drought has proved fatal to the Casuarina trees. Some twelve acres were planted at Camalapore with about 12,000 plants, intended for fuel for the railway; these had reached a height of forty to forty-five feet, and a girth of from nine to twenty inches, and were growing very well till last September, when they began to succumb to the lengthened drought, and about 70 per cent. died off. The rest will probably also go if the drought continues.—*Madras Mail.*

American Forestry.—At the recent meeting of the American Nurserymen's Association a memorial to Congress, praying for a commission to examine the forests of Europe, was adopted.

New Forests in France.—It is stated that several million acres being unproductive in France for farming purposes, the proprietors are taking measures to grow forests on these lands. It is estimated that in that country of high prices of timber, the lands will thus net 10s. per acre per annum in profit, and that there are enough of such lands in France to give an increase in productive profit of £5,000,000!

Rapid Growth of Hickory.—We measured a plant of a hickory (*Carya sulcata*) this summer, which in three years from the seed had made a growth of 3½ feet. On the grounds of Hoopes, Bro., and Thomas, at West Chester, is a tree of the same kind of hickory twelve years old, which is sixteen feet high and fifteen inches in circumference; and yet we hear sometimes that hickory is slow timber to grow.—*Gardener's Monthly* (*U.S.A.*).

Ornamental Maples.—The following remarks respecting some of the handsomest of the newer varieties of the *Acer* family are from Mr. Berry, of Longleat:—*Acer platanoides Lorbergi.*—This beautiful new variety of maple well deserves special notice on account of its richly coloured foliage, and free habit of growth. Its leaves, when newly unfolded, are a bright reddish purple, not much inferior as regards brilliant colouring to *A. polymorphum rubrum.* It will, I think, make a highly ornamental tree, and form a beautiful contrast to *Acer pseudo-platanus corstorphinense,* the foliage of which is yellow when fully opened in spring. *A. Wagneri laciniatum.*—This is a fine free-growing maple, with beautiful large, glossy, bright green foliage, which becomes richly coloured in autumn. *A. platanoides laciniatum.*—This peculiarly cut-leaved variety is not quite so vigorous a grower as the last named. Its leaves are deeply cut, and turned in at the points, giving them an appearance like that of an eagle's foot. *A. platanoides dissectum.*—This is another fine cut-leaved Maple, which is well worth knowing. *A. platanoides Schwedleeri.*—This somewhat resembles the last kind mentioned, but its leaves are a little larger, and it appears to be a more vigorous grower. *A. pseudo-platanus purpureum.*—This forms a stately tree; its foliage is large, handsome, and deep purple on the under side. A fine ornamental tree, suitable for park planting.

Trees in Cornwall.—The comparative absence of trees in Cornwall affords a remarkable contrast in this respect to Devonshire. On the high grounds they are few and poor, and even in the hollows they do not attain any great size. Running about for some days, we did not happen to see a single tree worth taking notice of, and half a dozen miles from the Land's End they utterly fail. On the whole, Cornwall may be described as a treeless land. The hedges, however—many of them at least—are, like those of Devonshire, magnificent. One in particular above the Linyher was a perfect marvel of vegetation. In the course of a mile or two we noticed growing on it in wild luxuriance nearly all the ordinary trees of the country—oak, beech, elm, thorn, hazel, birch, ash, bramble, ivy, with foxgloves, and dozens of other wild flowers past naming.—*Scotsman.*

As the present number of the Journal will come into the hands of our readers on the morning which witnesses the birth of another New Year, and when many of them, more especially in the northern parts of the kingdom, will be in the midst of the rejoicings and festivities which characterize that period, we may, perhaps, be allowed, before presenting our usual budget of information, to say two or three words of kindly greeting to the many friends who during the past few months have gathered round us, to lend us their aid in carrying out a work of no small difficulty. To these, then, one and all, we cordially wish "A Happy and prosperous New Year"—more happy, if possible, and more prosperous than the one which, amidst some gloom and depression both at home and abroad, has just flickered out.

In our September number we took occasion to remark on the satisfactory progress which the Journal had then made, and we said "we want more support and a much wider circulation." That appeal was not made in vain, and since then the flow of new subscriptions has come in steadily and constantly, if not always rapidly; but nevertheless there is still much to be done; there are still hundreds, nay—thousands—of large estates on which the Journal is not yet read, and whose custodians are monthly losing a fund of information which can be found in its pages alone, and for which no previous knowledge or personal experience can compensate.

To our contributors, who during the past year have so ably and readily assisted us, we return our heartiest thanks; without

their contributions the work could not have been carried on, and to their talent and assiduity a great portion of our success must be justly ascribed; and it is, therefore, with much confidence that we express a hope that during 1878 their pens may be fruitful, so that the garners of our columns may be well stored. The departments of the "Editor's Box" and "Notes and Queries" we are happy to observe have been well supported, but still more use may be made of them. We want every forester who, in the course of his daily rounds, comes across any single fact which he does not understand, to jot it down in his note-book, and forward it to us by the next post. No matter how simple the question, if it is something that he wants to know, he may rest assured that there are many others who are just as ignorant on the subject as himself, and he may be equally sure that amongst the readers of this Journal there will be someone who can give him a straightforward, reliable answer; then, again, in the "Editor's Box" the discussion on preserving wood posts, spruce timber, the prices of timber, &c., have led to the interchange of much useful information, and we hope to see many good discussions carried on with vigour and in a teachable spirit during this year.

These, then, Reader, are our new year's hopes and wishes: will you help us to realize them? If so, we shall succeed, and when we come to compare notes at the end of 1878 we shall find that our work has not been without its beneficial influence upon us all.

MANY planters of choice trees and shrubs have a settled prejudice against all grafted Coniferous plants, and specially against those of the Pine and Fir tribes. In bygone years there undoubtedly was much cause for such a prejudice; but with a better knowledge of the subject, and wider experience of its results, the operation is now performed with the greatest success in every nursery of note in the kingdom, and with the best ultimate effect on the plants when transferred to a permanent position. Without the process of grafting it would be absolutely impossible to get up a sufficient stock of many of the finest varieties of Pines and Firs, to supply the demand for such stately and handsome ornamental trees. By a proper selection of stocks and scions, in a good condition for "working," a neat and expert manipulator will perform the operation in such a successful manner that in the course of a few years it is almost impossible to detect the spot where the union has been made, and in the case of many varieties, the scion forms a more robust and handsome tree when grafted, than ever it can be got to do on its own roots, which in the case of *varieties* can only be produced with certainty from cuttings. We have been led to make these remarks from observing the beautiful

glaucous variety of *Picea nobilis* exhibited by Messrs. W. Paul and Son, of Waltham Cross Nurseries, before the Royal Horticultural Society. This is the most ornamental of the varieties of this noble Fir, and is to be found in most of the leading public and private collections of conifers in Britain; but to see it in all its glorious majesty, connoisseurs of Coniferæ should pay a visit to the famed collection at Castle Kennedy, Wigtonshire, N.B., where it grows by the hundred in all its pristine vigour and loveliness. To see the long avenues of this noble silver Fir, stretching across the smooth lawn and terraces between the old Castle of the Kennedys and the magnificent new Castle of Lochinch, with the sheen of its silvery foliage glistening in the rays of a bright autumn sun, is a sight that once seen is not likely to be easily forgotten. All these splendid trees, ranging up to 50 feet in height, are *grafted* plants, "worked" by Mr. Fowler, who for many years has been gardener there to the Earls of Stair, and under whose able and intelligent management the magnificent collection of conifers, for which Castle Kennedy is so celebrated, has been formed and grown into splendid condition, with great skill and wonderful success. In the early days of Ornamental Coniferæ planting, he was an ardent collector of every species likely to prove useful, and amongst other species got possession of the true glaucous or silvery variety of *Picea nobilis*. It was then very rare, and impossible to be procured in any quantity, but Mr. Fowler being a keen and accurate experimenter, as well as an enthusiastic admirer of handsome, trees, set to work to increase his stock of the silvery noble fir by grafting, and was thus one of the earliest in this country to prove beyond a doubt that most coniferous trees can be grafted with as much certainty and as good results, as any other family of plants in the vegetable kingdom. The chief point to be observed after the operation of grafting has been performed, is, to carefully watch and assist the scion to form a leader. Should it not do so of its own accord within a few years after being grafted, the head of the scion should be bent over and the point tied to a peg near the ground; the point buds pinched out, and also the leading buds pinched of all the strongest laterals, and by this means the scion is induced to break into growth from the base of some of the branches low down near to the graft. When such breaks have made an inch or two of growth they should be all rubbed off but two, which are left for the first season. The second season the best shoot of the two is selected for the future leader and the other pinched, to prevent it interfering with the symmetrical growth of the tree. The bent down top soon assumes the habit of a branch, and the grafted tree gives no farther trouble, and in many instances grows with a luxuriance never attained by the same variety on its own roots.

We would call the attention of our readers to the highly interesting *résumé* of the different species of *Populus* which we have the privilege to lay before them this month, from the pen of our able and esteemed correspondent, Dr. John A. Warder, of North Bend, Ohio, U.S.A., who was one of the members of the Scientific Commission sent from the United States to the Great International Exhibition of 1873 at Vienna, and is the author of a valuable Report on the Forest Products exhibited there. Dr. Warder's conclusions in reference to some of the species of Poplars possess much interest to botanists and scientific foresters who are desirous to know every tree by its proper and generally accepted name in scientific nomenclature, the advantages of which are undeniable, even for what is commonly called *practical* or useful purposes. European botanists may have some difficulty in agreeing with their American brethren as to what constitutes a *species* and what a *variety* amongst Poplars; but a correct knowledge of the various so-called species, or varieties, of such a valuable class of quick-growing timber trees is of the utmost importance to the forester, so that he may be able to select with certainty the species, or variety of a a species, best adapted for the purpose he has in view. Towards this laudable object Dr. Warder's contribution affords much matter for interesting and profitable study; and we may premise that further contributions on this and other highly important arboricultural subjects from our far-off friends will be much appreciated by ourselves, and acceptable to our readers.

Along with Mr. J. T. Allan, of Omaha, President of the Nebraska State Horticultural Society, Dr. Warder is an energetic promoter of the Memorial now before Congress to send a Commission to visit and inspect the Forests and Forest Schools of Europe, to which we have referred in former numbers. In regard to this subject our correspondent writes:—"I am happy to inform you that the matter has been favourably introduced into both Houses, and a Bill of a very liberal character reported in the House of Representatives, and referred in both Houses to Agricultural Committees, from which we hope to have favourable reports as soon as they can be got ready." We trust these efforts will meet with the encouragement and success they so well deserve, and we hope to have the pleasure of welcoming the Commission to our shores before the close of the New Year upon which we have just entered.

The sweet or Spanish chestnut (*Castanea vesca*) is generally believed to have been introduced into Europe by the Greeks from Asia Minor, about 500 years before the Christian era. It probably found its way to Britain through the Romans, who used its fruit extensively as an

article of food, in the same manner as the inhabitants of Southern Europe use it at the present time. In colour and richness of foliage, and the massive outline of its large and spreading head, it is unsurpassed by any other of our largest deciduous timber trees, for telling effect in park scenery, or in the general landscape. The famous *Castagno de Cento Cavalli* on Mount Etna is supposed to be one of the oldest as well as one of the largest of trees on record. Brydon, who measured it in 1770, gives 204 feet as the circumference of this ancient giant of the forest, but many have doubted if this were really one tree originally; Brydon himself says that it had the appearance of five distinct trees, only there was no bark on the inside, and he was assured the interior had been formerly a solid mass of timber. The most remarkable of these trees in England, and perhaps the oldest, if not one of those originally introduced by the Romans, is the gigantic tree at Tortworth Court, the seat of the Earl of Ducie, in Gloucestershire. It grows on the north-west slope of a hill, on a rich, loamy clay, and is said to have been called the "Great Tree of Tortworth," or "Great Chestnut," in the reign of King Stephen. In 1820, Strutt gives it a circumference of 52 feet at five feet from the ground, and the contents he puts at 1,965 cubic feet. Later measurements make it about 46 in circumference at the top of the swell of the roots. Many other noble Spanish chestnuts are to be met with in almost every county of England; and in Scotland trees are to be found from 25 feet to 30 feet in circumference, the latter being the girth of a tree growing near Cambusnethan, Lanarkshire. They are also to be found, over 20 feet in circumference, in various parts of Ireland; some grand specimens existing near Cappoquin, county Waterford, at Courtown, county Wexford, and in many of the old demesnes in the southern parts of the country.

In appearance and colour the wood has a great resemblance to that of the oak, but may always be distinguished from it by wanting the large transverse fibres or laminæ which are so distinctly seen in the wood of the oak. The latter, after a certain period, puts on an appearance very similar to that of the chestnut, and the roofs of many old cathedrals and churches, both in this country and on the Continent, which were once supposed to be constructed of chestnut timber, have proved upon careful examination to be that of oak. Chestnut timber was held in such high estimation towards the end of the last century, that the Society of Arts was induced to offer large premiums to encourage its more extensive planting by landowners. This had the effect of considerably increasing its numbers in the country, the Earl of Fife alone having planted about that time over 60,000 of it on his estates in Morayshire.

Evelyn, in his *Sylvia*, says that chestnut wood is good for mill timber

and waterworks, and that a great number of the ancient houses in the city of London were built with it, and that it is suitable for tables and other articles of furniture. Many instances are on record of the enduring qualities of its timber. In a paper communicated to the Society of Arts, it is said that a limb of chestnut, about thirteen inches square, which was put down as the hanging-post of a gate, carried the gate without alteration for fifty-two years, and when taken up was found to be perfectly sound, and was again put down for a clapping-post to another gate. In 1772 a fence was erected of posts and rails converted from young chestnut, and oak, of the same size and age. In 1791, the fence having to be removed, the chestnut posts were found to be as sound as when first put down, but the oak ones were so much wasted just below the ground that they could not be used again without a spur, thus proving the superiority of young chestnut over young oak for fencing purposes. The great excellence of the chestnut is in the early period at which it forms mature or heart-wood, it being no uncommon thing to find trees not more than thirty to thirty-five years old with the whole of the bole converted into heartwood, except two or three of the outer rings; and even in trees of only a few years' growth the proportion of heart to sap-wood is so great as to render poles of ten to fifteen years very endurable, and consequently of great value for such purposes as fencing and hop poles. In the midland and southern counties of England it has been found very profitable for the latter purpose, when grown as coppice on suitable soil. It is a highly popular and remunerative crop in the hop-growing districts, and is known to have realized as much as £60 per acre from the growth of fifteen years' coppice, and this too upon land which for any other purpose would not have realized more than a third of that sum in the same time. On deep rich sandy loam it grows with great rapidity, often averaging three feet of an annual growth, and forming a straight, clean stem, with a larger proportion of heartwood than is to be found in any other of our trees adapted for coppicing; hence its value for that purpose, and the high rate its produce brings in the market.

We have now seen the last of a year remarkable for the want of sunshine, and, we hope, exceptionally bad weather, more especially for farm and garden crops; but it still remains to be seen what effect the sunless season and heavy rainfall will have upon our forest crops. So far as we can learn from our numerous correspondents, as well as from our own observations, arboral vegetation has not suffered in the same degree as the crops of the field, garden, and orchard; but, undoubtedly, the want of heat and sunlight to mature and ripen the

gross, sappy growths, made under the influence of the moist, "muggy" summer and autumn, by many of our trees and shrubs, evergreens especially, will tell a woeful tale amongst them if it is followed by a winter of severe frost. Fortunately the early part of the winter has been remarkably mild, and the last month unusually dry, so that vegetation has had an excellent opportunity to ripen and brace itself up against the severe winter that may yet put to the test its stamina and hardihood. Most species of Coniferæ have made fine growths, which have now arrived at such a state of maturity that none except the tenderest sorts are likely to suffer much injury from any ordinary amount of frost; but we doubt if broad-leaved evergreens are so well prepared to withstand a severe or long-continued storm, such as played havoc among them in 1856 and 1860.

Most of the broad-leaved evergreens have continued to grow right on to the shortest day, and growth made in the dull days of autumn and winter can never be properly matured and ripened; but this is only half the evil, as growth going on keeps the whole system of the plant in action and full of sap, retaining it in the worst possible condition to withstand the severities of winter, and liable to be killed right off during the first hard frost. Rhododendrons, common and Portugal laurels, hollies, aucubas, laurustinas, and such like are clothed with a profusion of unusually large foliage, which, we hope, will get safely through the next two months without any serious injury.

The holly is richly laden with its scarlet berries, which contrast so beautifully with its dark green glossy foliage, quite enlivening our woods and shruberies at this dull season of the year with its charming glow of warm colour. From all parts of the country we hear of a heavy crop of holly-berries, in marked contrast to the scarcity which prevailed in most localities last year. Christmas has seldom had a finer or more plentiful supply of this most necessary adjunct to a due observance of its ceremonies and gaities; as, owing to the open weather, food of other kinds has been so plentiful for the "songsters of the grove," that they do not appear to have yet acquired a taste for the season's holly-berries. Hips and haws appear to be also a plentiful crop in most districts, so that the birds have an ample store of food against all contingencies.

Cultural First Principles.

By G. S. BOULGER, F.L.S., F.G.S., late Professor of Natural History in the Agricultural College, Cirencester.

V. Root and Stem.

(*Continued from page* 533.)

Plants take in their fluid nutriment mainly by their roots; that which is gaseous mainly by their leaves. The stem is physiologically little more than a connection between the root and leaf systems.

The roots of plants, though sometimes produced from the leaves or branches, as in the growth of cuttings and layers, when they are termed "adventitious," are normally formed from that part of the embryo of the seed, or "chit," which is called the radicle.

Roots require a moist medium for their growth, and do better in darkness. They increase chiefly in length by the growth of cells just behind their apex, which is pushed forward like the shield used in tunnelling.

Some trees have what are known as proliferous roots, that is, roots which will produce buds: such are the plum, apple, poplar, and hawthorn, which may therefore be propagated by "root cuttings." Flowering plants are divided into two well-marked groups, known as dicotyledons and monocotyledons, all our forest trees belonging to the first division. These (dicotyledons) are characterized by having tap-roots, the wood of their stems increasing externally by the addition of new concentric "rings" of growth, which in our climate generally each represent a year, by having leaves the veins of which form a network, generally somewhat irregular, by having four or five sepals to the calyx and four or five petals to the corolla, and by having two lobes or seed-leaves to the embryo of their seeds, which, being known as cotyledons, account for their name. The monocotyledons, on the other hand—of which we may take the lily, the asparagus, the palm, and the wheat as examples—have no tap-root, have no rings of wood in the stem, but have their timber harder near the circumference than in the centre, have the veins of their leaves regularly parallel, have their petals, or other floral organs, in threes, and have only one cotyledon.

The *tap-root*, then, of a dicotyledonous tree, with which we are

alone concerned, generally branches considerably, its minor ramifications being known as rootlets.

The *root serves a threefold purpose.* It fixes the plant, it absorbs nutriment, and in many cases it stores it for future use.

I need only illustrate the first function by mentioning that in nursery gardens the tap-root of apple, peach, and other trees is removed when they are young to facilitate transplanting. On the other hand, the untouched roots of the ash have been known to reach a length of ninety-five feet; and I think I can testify to those of the Lombardy poplar attaining an equal length.

The absorption of food from the soil is the most important function of the root. This function is performed by the whole surface of the root, which is still young and unhardened in texture; but more especially by myriads of microscopic hairs, with which the rootlets of most trees are covered.

The silver fir (*Abies picea*) has no root-hairs, but a delicate, highly absorbent cuticle or surface-layer, with very numerous rootlets. Old roots acquire a corky rind which renders them impervious, the function of absorption being then transferred to the rootlets.

The soil has great influence on the extension of roots, they being thicker and numerously branched in rich, and attenuated and with but few rootlets in poor soils.

It appears at first as if roots went in search of food, the real fact being that they can only grow in those directions in which they find food. They send out rootlets in all directions, but those which find no nourishment remain no further developed.

The cells of the rootlets and their prolongations, the root-hairs, take up liquids from the soil in the same manner that in the plant liquids pass from one cell to another, that is by the physical process known as "osmose," each root-hair being closely applied to a particle of soil, and the moisture in the soil coating its constituent particles. One of the substances roots give out in this process is carbonic acid, which acts as a solvent on carbonate of lime. This was proved by Sachs, who sowed seeds in sand on polished plates of marble (calcium carbonate), dolomite (calcium-magnesium carbonate), and osteolite (calcium phosphate), and found that an impression of the root-system was etched or eroded into the stone.

The *stem*, though not usually contributing to the nutrition of the plant, is, of course, of paramount importance to the forester. It is the medium by which the food-substances are conveyed from the roots, and also partly the laboratory of physiological change and the storehouse of the plant, as well as the framework which spreads out the leaves or manifold stomach and lungs of the plant into that important food-supplying medium, the air. The stem originates in a

bud, the "plumule" or "gemmule" of the embryo, and during its growth is terminated by a bud at every growing point, only ceasing to be so when it produces a flower at the end of the shoot, or loses it from injury or disease. The way in which buds develop determines the shape of the tree. Buds develop into branches; but in a forest where the trees are thick the lower branchlets die from want of light, so that the tree appears to have been always destitute of lower branches. These, however, leave evidence of their former presence in the knots in the wood.

It may be said generally that every plant-cell is capable of independent growth, so it is hardly an anomaly that stems or branches mechanically injured, as in felling or pollarding, have the power of throwing out "adventitious" buds from their stumps. The stem of the lower groups of plants and that of the higher when in its earliest stage consists merely of cellular tissue; but in the latter "vascular tissue," made up of vessels or ducts formed by the obliteration of the horizontal partitions between cells, and of long lignified wood-cells, soon originates. These ducts and wood-cells are grouped in bundles and in all "dicotyledons" these are arranged in rings, being formed just within the bark, which at first is merely the single layer of superfical cells or "epidermis." The cellular tissue of the interior of the stem persists, when surrounded by the rings of woody bundles, as the "pith," and extends between the constituent bundles of these rings as the "pith-rays," "medullary rays," "silver grain" or "felt." These rays are well seen in beech, oak, and maple, less distinctly in lime, yew, and chestnut, and are not traceable in fir wood. Though the pith, at first full of sap and active in growth, is often broken up in herbaceous plants, leaving a hollow stem, in trees it remains as a mere point or line in the centre of the stem.

The cellular tissue between the epidermis and the young woody bundles remains in a growing condition, and is called the "cambium." In its outer portion annual layers of long, tough cells are formed, which are known as "bast." These render the bark tough, and enable it to be stripped off. These annual layers are sometimes separated by cellular tissue, and may thus be divided, as in Russia matting, the lace bark, and Cuba bast, the products of the lime (*Tilia Europæa*), *Lagetta lintearia*, and *Paritium elatum*. Most other textile materials, except cotton, are bast.

The epidermis of young stems is replaced by the cork layer, which gives their external appearance to different trees. In the birch it is formed of alternate layers of large and small cells, and so splits off and rolls up. In the plane it is thrown off in plates; whilst in the maple, elm, and oak, especially the cork oak (*Quercus suber*), it receives regular additions from the inside, and, not separating, becomes

of considerable thickness, and is split by longitudinal furrows, owing to the increasing diameter of the growing stem.

In the inner portion of the cambium are formed the woody bundles in a circle round those of the previous season of growth. In spring-time the cambium forms large but delicate cells, which are easily broken, so that the bark may be stripped easily from the wood More ducts are seen in wood, especially oak, formed at this season than later on, *i.e.*, at the interior of the annual layer. Later on the cells formed in spring become so thickened as bast or wood that the bark cannot be peeled off, and the less active vitality of the tree is marked by the formation of smaller cells.

The rings of woody bundles when first formed are full of sap, and though growth is confined to the cambium, the passage of sap and deposition of lignine in the cells goes on in the younger layers generally for some years. It is hence called the "alburnum," or sapwood. Mainly from this lignification, but partly also from cohesion, the older or more central portion of the stem becomes much denser, often of a darker colour, and so impassable to sap that it may decay without impairing the tree's vigour. The distinction between the sapwood and this "duramen," or heartwood, as it is termed, is well seen in ebony and laburnum.

In order to show the importance of apparently unpractical matters I make no excuse for quoting the three following paragraphs from "Timber and Timber Trees," the excellent work of a high authority, Mr. Thomas Laslett, of Woolwich :—

"In the employment of timber in carpentry due regard must always be had to the position of the pith, since there is an outside and an inside to every board and piece of scantling; and the careful workman is so well aware of this that he will study to leave, if possible, in any work of construction the outer side only exposed. It is, therefore, necessary in every case to look for the pith or centre of the stem, or, if that has been removed by the conversion of the tree, for the innermost or oldest layer of heartwood in the plank or board, as that will be the inside of it. If this precaution is disregarded the innermost or earlier layers of wood will lift and shell out after exposure for a time."

"Timber should be cut as nearly as possible in the direction of the pith rays, the shrinkage in seasoning being, for the most part, angular to them. Workmen in general, and modellers in wood in particular, endeavour to embrace the greatest length of medullary figure in their work to guard against warping. Others, who are engaged in the cleaving of posts, rails, or palings for park and other fences, know that they can only successfully do this by rending the piece in the direction of these rays. It is by a careful study of this that we obtain our

best and most beautifully figured wainscot from the slow-growing oaks found in the north of Europe, Austria, Asia Minor, and in some districts of North America."

"It might be supposed that the innermost or earliest layers being the most matured would be the strongest; but experience teaches us that this is only true up to a certain period of growth, and that in the majority of cases the maximum of strength and toughness lies nearer the more recently formed outer heartwood or duramen. For this reason it becomes a matter of great importance in selecting timber for use—especially if it be intended for works of any magnitude—that logs should not be taken of dimensions much in excess of the specification given, but corresponding as nearly as possible in size to it, as the removal of more than a few of the outer layers of heartwood is likely to involve a serious loss of strength."

THE "MILK" TREE.—What most interested us (says a South American traveller) were several large logs of the masseranduba, or milk tree. On our way we had seen some trunks much notched by persons who had been extracting the milk. It is one of the noblest trees of the forest, rising with a straight stem to an enormous height. The timber is very hard, fine grained and durable, and is valuable for works which are much exposed to the weather. The fruit is eatable and very good, the size of a small apple, and full of a rich juicy pulp. But strangest of all is the vegetable milk, which exudes in abundance when the bark is cut. It has about the consistence of thick cream, and but for a slightly peculiar taste could scarcely be distinguished from the genuine product of the cow. A man was ordered to tap some logs that had lain nearly a month in the yard. He cut several notches in the bark with an axe, and in a minute the the rich sap was running out in great quantities. It was collected in a basin, diluted with water, strained, and brought up at tea-time and breakfast next morning. The peculiar flavour of the milk seemed rather to improve the quality of the tea, and gave it as good a colour as rich cream. In coffee it is equally as good. The milk is also used for glue, and is said to be as durable as that used by carpenters. As a specimen of its capabilities in this line we were shown a violin that had been made, the belly-board of which, formed of two pieces, had been glued together with it, applied fresh from the tree, without any preparation. It had been done two years. The instrument had been in constant use, and the joint was now perfectly good and sound throughout its whole length. As the milk hardens with exposure to the air, it becomes a very tough, slightly elastic substance, much resembling gutta-percha; but not having the property of being softened by hot water, is not likely to be so extensively useful as that article.—*N. W. Lumberman, U.S.A.*

Poplars, Aspens, and Cotton-Woods.

By Dr. JOHN A. WARDER, North Bend, Ohio, U.S.A.

I have had the pleasure of seeing the May number of your excellent Journal of Forestry, which but recently came to hand, and with which one cannot fail to be pleased, since the English-speaking people of the United Kingdom, and also those of the United States, who are rapidly becoming interested in forestry, begin to feel the need of such a periodical, and we may soon find it necessary to establish one specially adapted to our needs here in America. Success, say we, to your Journal.

In your Editorial Notes, at page 9, is an interesting account of what you are pleased to call the Black Italian Poplar, which you refer to the species *Populus monilifera.* With your popular names we are not expected to be familiar, and as we have the Lombardy poplar from Europe, now accepted as a form of *Populus nigra* of that continent, the words Black Italian* would lead us to think of the Lombardy, long believed to be *Populus dilatata* of Aiton.† Indeed, one of our best informed American dendrologists, Mr. Thomas Meehan, editor of the *Gardener's Monthly*, seems to have been of this mind, since in the November number of his valuable serial he ventures to correct your citation from Loudon, and gives *Populus nigra* as the proper name for your tree.

In this I do not concur, for a careful reading of your article gives evidence of a plant very different from the Lombardy, which is essentially a densely clothed pyramidal tree, rarely if ever having a "clean bole."

You may be right in referring your tree to *Populus monilifera*, though, unfortunately, this is one of the questionable species, respecting which botanists are not fully in accord. At this distance, and with the meagre evidence presented, omitting all botanical characters except the habit and habitat, it may be thought presumptuous for any one to express an opinion, but it is modestly suggested that some other American poplar may have been introduced into Scotland, and that your tree may be *Populus angulata* of Michaux, or his *Populus monilifera*, which last he calls the Virginia or Swiss poplar, and says it is extensively cultivated for timber in Europe, especially in Switzerland and France. The Carolina poplar, *P. angulata* of Michaux, is

* Nuttall calls this the Italian Poplar, or Lombardy. "Am. Sylva," vol. i., p. 55.

† As does Darlington in his "Agricultural Botany," 2nd ed., p. 332.

is commonly planted in Belgium; either of these might answer the description of your tree.

The Poplars are not esteemed in this country where hard woods abound, and are preferred [for construction; but in the great prairie regions, where the scarcity of woodlands is forcing the people to plant, and where millions of trees are annually set out, the rapid growth of cotton-woods and their easy propagation from seeds and cuttings make them favourite pioneers for the future forests which must be planted. This, too, is following the natural indication, for in our progress westward from the wooded regions of the Ohio valley the cotton-wood is the proper arboreal form, and while almost all others disappear, these continue to recur along the streams to their very *cañons* at the base of the Rocky Mountains.

However, in the beginnings of an American Forestry, yet to be developed, we advise the planting of cotton-wood first, to act as windbreaks under the shelter of which adjoining lands may afterwards be planted, with many other species which would have inevitably succumbed to the dry blasts from the prairies and open plains. With your leave, a brief conspectus of the poplars of this country and Europe is here presented, as the result of a recent study of the genus with the aid of such works as were at hand in my limited library, and supported by my own observations. In this article they will be divided into the three very natural groups of Poplars, Aspens, and Cotton-woods.

Poplars.

1. *Populus balsamifera,* Tacamahaca, or Balsam Poplar, is a very distinct species. This is essentially a northern form, being found as far north as the Great Slave Lake,* in latitude 63°. Tree of medium to large size, with open, straggling branches, leaves are on roundish petioles, oval, coriaceous, dark green above, rusty brown beneath. Though unseemly, it is somewhat cultivated.

2. *Populus candicans* (Aiton) Balm of Gilead, Heart-leaved Balsam Poplar—is now considered merely a variety of the above. This form is seen chiefly in cultivation, though it has little to recommend it. The buds of both these are large and abundantly covered with a balsamic resin that has been used in medicine.

3. *Populus angustifolia* (James), is desribed by S. B. Watson† as a common tree in the Rocky Mountains. It is now grouped with *candicans* and *balsamifera,* of which it is a very distinct western form: different trees and locations present quite a variation in the foliage, some leaves being ovate, while in other trees they are nearly linear,

* Dr. Torrey in Nat. History of New York, Botany, vol. ii., p. 216.
† Clarence King's Survey of the 40th Parallel.

and with a drooping spray the resemblance to a willow is very striking, as seen on the Platte River or Denver Colorado. Nuttall considered this a good species, and says it becomes a noble tree on the western coast.

4. *Populus tricocarpa* (Torrey), is another western form, found in Truchee Valley, Nevada, and elsewhere in the heart of the Rocky Mountains, as well as on the Santa Clara River, California.*

5. *Populus nigra* (Linn.), European Poplar, was not recognised by the Michaux and Pursk, though they found a form of it growing in New York City, and on the Hudson river near Albany, which was described as the *P. Hudsonica* by Michaux, and by Pursk as *P. betulifolia*. There is now no doubt about its having been introduced from Europe, where it grows to a large size, and with *P. alba* is much used along the banks of the Danube in reclaiming low and overflowed lands. The thickets arrest the *débris* of floods, and furnish abundant material for the fascines used in the weir-drovs and levers placed along the river for the improvement of the navigation of that noble stream.

10. *Populus dilatata* (Aiton), the Lombardy, or Italian Poplar, is no longer looked upon as a species in this country, but merely as a variety or sport from the *P. nigra*. This plant is extensively grown as an avenue-tree along the highways of Southern Europe, where it appears to be a great favourite, notwithstanding its formal habit. It does not appear even there to be valued for its timber, and is never seen in forest plantations.

The Lombardy was very early introduced into this country. In 1784, it was planted by Wm. Hamilton, Esq., on the site of the Centennial Exhibition (*vide* WATSON'S ANNALS OF PHILADELPHIA), and extensively planted elsewhere, particularly in the streets of towns and cities. In the eastern States very large trees may yet be seen in good condition, but in the western States, especally in Northern Illinois and Wisconsin, it has been largely planted in fence rows and wind-breaks with fine effect. In our soil, however, the tree does not promise to be long-lived. The plants in this country are all staminate or males, and have been multiplied by cuttings. How is it in Europe? †

ASPENS.

The aspens, or abeles, form a distinct group; they are usually smaller trees, as we see them here, especially the native species.

* NORTH AM. SYLVA, MICHAUX and NUTTALL. Vol. iv. of Nuttall, vol. i., p. 54. Philadelphia Edition.

† This question is already answered by my friend and jury colleague at Vienna, Giovanni Carlo Sismoris, who says this Poplar, which he also calls the Cypress or pyramidal, and *P. Italica* Dur., is considered only a variety of *P. nigra*. No firmer plants are known. He adds that it is much cultivated in Lombardy, and particularly along the Po. In evidence of its antiquity he quotes Ovid.—MANUALE D'ARTE FORESTALE, 1872, p. 137.—J. A. W.

11. *Populus tremuloides* (Michaux), Quaking Asp, is a small tree, seldom more than twenty to thirty feet high, and a few inches diameter; and in the north it becomes a mere shrub. A form of this species in the valleys of the Rocky Mountains springs up spontaneously in the greatest abundance wherever the woodlands have been burned over. The older trees have stems of fifty to sixty feet in height, and are used in construction. This plant is almost unique as a deciduous tree, among the evergreen conifers of that extensive region. Generally speaking this species has little value, but there are some peculiar forms of this and the next that are cultivated for effect in gardens and parks.

12. *Populus grandidentata* (Michaux), the Michigan Poplar of the nurserymen's catalogues, is a much finer tree than the last, and also northern in its habitat. On account of its rapid growth this tree has received much attention among western tree-planters, and though only a poplar, considerable merit has been accorded to it as a fencing material;* the poles cut in early summer and tested, have been found to last ten and twelve years when nailed to posts as a fence; they are, however, like all their kind, deficient in strength and easily broken.

13. *Populus canescens* (Michaux), or more correctly *P. alba*, L., Abele is the common white or grey poplar of Europe, with its many forms or varieties of Abele, Athenian, maple-leaved, and silver poplars.

Though widely diffused and planted everywhere, and wonderfully multiplied by numerous suckers in their new homes, these are all believed to be of European origin. If correctly understood, however, my good friend Professor Karl Koch, of Berlin, who has made a life study of trees, considers this species to be American, or common to both hemispheres. His valuable work is just now, unfortunately, not at hand.†

In Southern Europe the white poplar becomes a noble tree, attaining the height of 90 to 100 feet, and a diameter of 5 to 6 feet, as seen in the Praterat, Vienna, Austria. The timber is much used in the construction of buildings and for other purposes in Europe, and the tree may be found valuable to our own western planters. Michaux claims two distinct trees, the white and the grey, attributing superiority to the latter.

Populus tremula (Linn.), Trembling Poplar or Aspen, the congener of our *P. tremuloides*, is a European tree of small size and of little value, except to cover denuded tracts as a restorer of the soil, preparatory to the introduction of some other more valuable species.‡

* Forest Trees. Arthur Bryant, sen. New York, 1871, p. 124.

† K. Koch's Dendrologia, Berlin.

‡ Man. Forestale, G. C. Sizmoni, p. 86.

Cotton-woods.

These form a characteristic group of the family, and are believed to be essentially American in their origin. Many have been transplanted into European soil, and thrive as well in their adopted home as though to the manor born. In their native land many of the Cotton-woods attain majestic proportions, and they are not without their value. The great logs were easily wrought into canoes by the aborigines and early settlers. They provided food for the native beavers as well as material for their subaqueous structures, and the pioneers of the West often helped to sustain their live stock during winter by the coarse forage furnished by the soft wood and large, almost succulent buds of the branches of trees cut down for the purpose. The lumber, though inferior for most purposes to the hard-wood species, was, and is still, used to a considerable extent in some parts of the country, and the Cotton-woods are planted more numerously than any other trees in the new forests that are rapidly spreading upon the borders of the great plains. These will effect the double purpose of furnishing abundant supplies of fuel and timber in a few years, sheltering the open country, rendering it more habitable as well as more productive in cattle and crops. But, best of all, they will enable the forest planter to introduce other and more valuable kinds of trees for the future wants of the people that are destined to cover these vast areas, that have been heretofore but desert steppes so far as human habitations were concerned, and only roamed over by hordes of savages, and by herds of the ruminant buffalo of the plains.

With great diffidence the determination of some of the species has been reached by the writer, who gracefully bows to the magnates of Botanical science; but where even these are in doubt, who shall decide?

There is some uncertainty as to the designations given to these plants by botanists, some of whom, perhaps, had only herbarium specimens, and the unsatisfactory descriptions of non-scientific though intelligent travellers from which to make up their diagnosis.

14. *Populus angulata* (Michaux), the Carolina Poplar. Michaux says this species, which he first met under the name of Carolinian Poplar, was found in the south of Virginia, and also on the Mississippi and Missouri rivers, growing with the Cotton-wood, his *P. Canadensis.* He describes it as a tall-growing and upright tree, which is the character of the Carolina Poplar as now known. The buds are short, dark green, and destitute of the viscid resin found on those of the Cotton-wood proper, and on most other poplars.

This is believed to be the tree so prevalent in Belgium, where it is

planted along the lines of the canals, for which position it is peculiarly adapted by its upright habit, that is persistent even when grown singly.

15. *Populus Canadensis* (Michaux), the Cotton-wood, is considered by our excellent botanist Dr. Gray to be the *P. monilifera* of Aiton,* and the same also as the *P. lævigata* of Willdenow. However, Wood's No. 5, *P. monilifera*, after Aiton also, seems to be different, and he gives its habitat "on the Hudson near Troy, New York,"† and quoting Dr. Beck, "'apparently native.'"

Michaux found this species as far north as latitude 43°. It is abundant in the Black Swamp of north-western Ohio, and fine trees may be seen on the bank of the river below Detroit, Michigan. Michaux describes the tree as larger than *angulata*, and the bark as thicker and more deeply furrowed, having also a rounder head, and with the boughs more numerously branched. This character of the outer bark has attracted the attention of the fishermen on our great lakes, who utilize it as a substitute for the more costly bark of the *Quercus suber*, or cork. Sections of this substance, often three inches thick, turned into oval form and perforated, are used as floats to their gill-nets.

Michaux reports this species rare on the Atlantic slope, but very common in the Mississippi valley, especially above the mouth of the Arkansas.

The cotton-wood is the chief source of the steamboat fuel used on our southern rivers.

16. *Populus monilifera* (Aiton), the Virginia or Swiss Poplar, does not appear to have been found in this country by Michaux, father nor son, but they say it is extensively cultivated in Europe, especially in Switzerland and France; though the males only are found there.

The young shoots of this species are angular. Comparing it with the cotton-wood, M. Foucault‡ says the leaves are smaller and less distinctly heart-shaped; the young shoots and twigs are smaller and less angular, becoming cylindrical in the third year, and the limbs are less divergent than those of the cotton-wood. It also grows faster, and succeeds in drier soil, hence its popularity in France. The wood is said to be softer than the cotton-wood of Michaux, or *P. Canadensis*.§

Dr. Torrey found it in Western New York, on Lake Oneida and on the Genoa river.¶

* Manual of Botany, Asa Gray, 2nd Edition, 1856—his No. 4, page 419.

† Class Book, Alphonso Wood, 41st Edition, 1855, page 507.

‡ Imperial Director of Forests and Watercourses of France, quoted by Michaux as the highest authority. North American Sylva, vol. ii., p.120.

§ This species is cited as *P. monilifera*, (Mœnsch), by Sirmoni, in his Manual, p. 237.

¶ New York Nat. History; Botany, vol. ii., p. 205.

17. *Populus argentea* (Michaux), or the Cotton Tree, and according to Gray the *P. heterophylla* (L.), is found in the middle, western, and southern States. Michaux refers to Fort Massac, on the Ohio river, and to a large swamp in Southern Illinois, as its habitats. The tree is large with thick bark, and the shoots are round, the leaves very downy when young, becoming large when expanded, and having the lobes at the base overlapping each other. The wood is described as inferior; becoming yellowish at the heart.

All these trees would probably receive the common name of *cotton-wood* among our western wood-choppers; indeed, they bear a very near resemblance, and have close analogies, which might very properly be referred to a conference of eminent botanists and foresters for a settlement of the questions which now exist. The sub-group of Poplars, which has been consolidated, embraces kinds more dissimilar than some of the cotton-woods that are still recognised as distinct species.

In this hasty review of a numerous genus, which occupies so large a space in the northern temperate regions, the endeavour has been made to compress a great deal within the limits of an article for the JOURNAL OF FORESTRY: perhaps too much has been attempted, and much certainly has been introduced to enable the reader to follow intelligently. For the sake of brevity all new botanical descriptions have been omitted, but these can readily be found by the student in the works of the Authors referred to in the text.

A GOOD FENCE.—A post and rail fence that I think goes ahead of anything I have ever seen, patented or unpatented, is made as follows: Set the posts nine feet apart, or two feet less than the length of the rails used. Bore an inch and a quarter hole through the posts one foot from the ground and at right angles with the direction of the fence. Bore three holes above this one nine inches apart, one above the other, and drive in wooden pins in all four holes to project four inches on each side of the post. Lay your rails on these pins, close to the post on each side. Bore a three-eighth's hole above the top rail, and another one an inch and a half below the bottom pin. Take a piece of wire ten or eleven feet long, and pass half its length through the top hole, and cross it under the top rail; cross it again under the second rail from the top; cross it again under the third rail, and finally cross it under the bottom rail by slipping the ends of the wire through the small hole, and bring them around in front of the post and twist them together. This makes a cheap strong fence, that will turn horses and cattle; but if sheep are kept, a board should be nailed at the bottom, or a fifth rail added.—*Albany Argus, U.S.*

The Construction and Maintenance of Roads.

By ALFRED J. BURROWS, Pluckley, Kent.

(*Continued from page* 555.)

The accompanying diagram (fig. 1) of a road section is given as an illustration of the method of construction recommended in a former article. A B represents the surface of such a road, 15 ft. in width and having a convexity of 1 in 30, or a fall of 3 in. from the centre to the sides. Its entire depth from A to G is 18 in., and the bed upon which it is laid has the same convexity, to enable water to escape more readily to the side drains. G H is a bottom of flat stones about 7 in. in thickness, closely packed in the form of a pave-

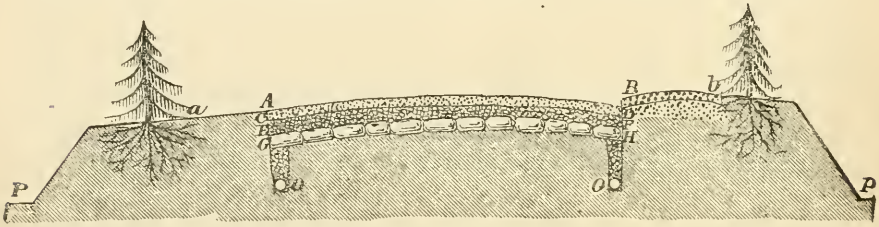


Fig. 1.

ment, and well rammed down upon the soil. E F is a layer of good road metal, broken into 2 in. cubes, and laid on to a thickness of 6 or 7 in., and thoroughly consolidated by rolling, ramming, or carting over the surface with broad wheels. C D is a coating of finely broken stone or gravel of the best quality, 4 or 5 in. in thickness, covered with fine chippings from the quarry, or with sand, and then well watered and rolled down.

Where the upper coating consists of angular or broken stone it cannot be too carefully sifted or freed from dirt, as the angularities will produce interlocking and complete binding; but where it consists largely of smooth or rounded pebbles it is a mistake to divest them of all earthy matter, as in such a case they will bind only when they become crushed, by which time the surface of the road is materially weakened.

It should never be forgotten in road-making that the larger the amount of earthy matter embedded in it, particularly when this is of a clayey nature, the greater the loosening effects of frosts.

O O are pipe drains laid along both sides of the road, at a depth of not less than 18 in. or 2 ft. below its foundations, and discharging their water into the side ditches P P. The spaces between the pipes and the road foundation are filled up with rough broken stone. B b is a raised footpath, which should be placed upon the highest ground, having its surface somewhat above the centre of the roadway. Where practicable the water-table, A a, is best upon the S., S.E. or S.W. side of the road. Upon land of good quality it may not be considered advisable to have open ditches. In such cases good pipe drains may be covered in and become carriers for the road-water, and also for that from the adjoining lands, where the slope of the ground will permit this.

One great advantage of having a ditch upon the field side of the hedge is that it enables the fence to be cropped low, and thus sun and air are admitted. Again, where the ditches are close to the road, and large stone is laid on, much of it continues in motion till it finds its way into the ditches.

The only drawback to the general use of finely broken stone is the cost of manual labour. But in these days of steam, when traction engines are largely used for delivering road stone, why should it not also be crushed by steam-power? One of Blake's stone-breakers, manufactured by Marsden, of Leeds, costing about £240, and driven by an engine of 8-horse power, will break down 6 cubic yards of the hardest stone per hour; and though the cost of construction of such a road as we are recommending may be a somewhat heavy item, the expense of its maintenance will be reduced to a minimum.

Before proceeding to lay out main clearance roads and wood rides, there are several points requiring careful consideration. Among these may be enumerated the following:—1. To afford the greatest possible facilities to the proprietor and the wood buyer for effecting a clearance. Before bidding for a lot the latter will be certain to discount it heavily for all its disadvantages of removal, as well as for any unnecessary restrictions which may be imposed. 2. A complete subdivision and consequent perfect ventilation of the whole wood. 3. The exclusion, as far as is practicable, of all destructive winds prevalent in that locality, by opening roads transversely to the direction of their currents.. 4. To cause all secondary roads to converge upon the main ones at convenient points, by which means the whole or any portion of the wood will be divided into parts resembling the sectors of a circle, which will enable the sportsman to beat from the outsides to the central points. 5. Where possible, to cause the rides to diverge towards prominent distant objects of interest, whether natural or artificial, such as a mountain, a hanging wood, a mansion, church, windmill, &c. 6. To bring within view any beauties of the

wood itself, such as noble single trees or groups of such, lakes, streams, cliffs, &c. 7. To avoid extremes of inclination as well as swamps and low-lying situations.

The width of all wood roads and rides should be proportioned to the extent of the plantation, as what might be sufficient for an enclosure of from twenty to fifty acres would appear contemptible in a wood several hundreds of acres in area. In the latter, main roads may be from twenty-four to thirty feet wide, though only such a breadth need be metalled as will permit carriages to pass each other. If the material taken from the side ditches be thrown into the centre of the road, the necessary convexity may be obtained, and soundness secured—a great point where the turfed sides are generally chosen by equestrians. Here a coating of good stone seven or eight inches in thickness will generally be sufficient, if laid on a firm bottom. It is, however, never advisable in forming such a road to place the broken stone immediately upon very stiff or retentive clay, as such clay by its great absorption of water and consequent expansion in wet seasons, and its contraction under solar influences, keeps the road open and loose. A few inches of good burnt ballast, or even a layer of vegetable mould, placed between the stone and the clay will remedy this.

Good open ditches at the sides are generally sufficient for the drainage of such roads; but where the land is springy it may be advisable to cut a very narrow trench along the middle, giving it outlets to the sides, and fill up with broken stone.

As a feeling of security adds so much to the enjoyment of a ride or drive, and as large open ditches close to the sides of the road are generally unsightly and always dangerous, it is questionable if such ought not to be concealed immediately behind the front line of trees or shrubs. In some places, owing to great inequalities of surface, it becomes necessary to cut a ditch of more than ordinary depth, whereby the danger is increased. When such are partially concealed their sides may be *benched* or *stepped*, and their upper portion planted.

In excavating side ditches their slopes must of course depend upon the nature of the soil and its susceptibility to atmospheric influence. Alternate layers of clay and sand are very liable to slip. As a rule about $1\frac{1}{2}$ of base to 1 perpendicular will be a good slope, though it may sometimes be necessary to exceed this.

Where low-lying and boggy places have to be crossed, it is customary to bottom the road with bavins or fagots. In practice we have found larch and alder useful for this purpose; and for a few years such a roadway may be fairly sound and dry; but when decay sets in the stone is rapidly swallowed up in the rotten wood, and the road is ruined. Better far to secure good drainage, and give an extra

depth of ballast or stone. Here, good clearance roads for one season are made by laying down brush fagots transversely, about 40 to the rod. Heavy loads of hop-poles and fagots, and also fair loads of timber may be carried over such.

Main roads are generally ornamentally planted, while secondary rides may be closely trimmed up at the sides, thus presenting in spring and summer walls of living green. They may be of all widths down to 10 feet. If narrower than this they are inconvenient both to the horseman and the sportsman. Their attractiveness will be very much increased if they are recessed at intervals, and planted with choice trees for permanent standards.

Rides may be either sown down with grass seeds or speedily turfed by the system of inoculation. Where they are sown, about 25 or 30 lbs. of seeds per acre will be required. These should consist principally of wood meadow-grass, and the rough-stalked and smooth-

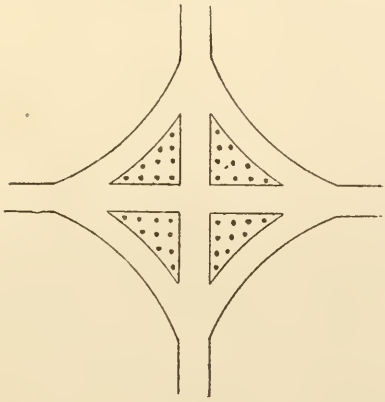


Fig. 2.

stalked varieties of meadow-grass. To these may be added a few pounds of cock's-foot, with a little sweet-scented vernal, some fescue and meadow fox tail,—the whole to be sown broadcast, and afterwards brushed in and well rolled.

But a far more effective and a quicker means of obtaining a good turf presents itself in the system of inoculation, which consists in depositing by hand, at tolerably regular intervals, small pieces of turf which have been cut from an old pasture, in narrow strips, by means of Howard's, or any other paring plough. An implement of this kind, manufactured by Messrs. Howard, of Bedford, for the Duke of Manchester, cuts at once three ropes of turf, each 2 inches broad by 1½ inches thick. In laying down pasture these turfs are carted to the spot, and afterwards broken in pieces and placed about 9 inches apart, trodden down and rolled firmly. Where this

is done in November the tufts seed freely the following year, and produce a sound and even turf by the end of the second year. If not cut deeper than two inches the wounds in the old pastures heal up rapidly. A few pounds per acre of the rougher kinds of grass seeds would materially aid the formation of a firm turf; while a fair dressing of chalk would also strengthen it permanently.

The system of inoculation, though only recently revived, was practised and written upon early in the present century. It was successfully tried in Norfolk and in Lincolnshire, and a treatise was written upon it by Francis Blaikie.

Where narrow wood rides cross each other, and afford scarcely room enough to turn a carriage, it will be an advantage to lay out the corners as shown in fig. 2. If the triangular portions are ornamentally planted with a distinct species of tree, it will not only greatly improve the appearance of the rides, but also afford a ready means of designating any particular crossing—such as *Pine Corner, Wellingtonia Point,* &c.

(*To be continued.*)

Mulching Newly Planted Trees.—To prevent recently planted trees from suffering for want of moisture, there is no cheaper or more effective method than mulching the soil above the roots with some coarse fibrous material, such as hay, straw, or coarse manure from the farmyard. Tan bark, sawdust, or leaves of any kind will answer the purpose, and in regions where long droughts are likely to occur in summer, the mulching should never be omitted, but considered a part of the operation of transplanting the trees. If the ground for the space of four or five feet about the stems of the trees is covered with a mulch as soon as they are planted, it will often prevent their dying, and insure a vigorous growth. The soil under the mulch holds moisture much longer than when exposed to the direct rays of the sun, and it never becomes so hard that the most gentle rains fail to penetrate it, or so hot as to rapidly expel moisture. Those who have experienced more or less difficulty in making evergreen or deciduous trees live when transplanted, would do well to try mulching and see if they do not have better luck. We think it is far preferable to watering, which so many people practise in order to save their trees. If water be supplied, it should be given in abundance at certain stated periods, and not a little at a time, which frequently does more harm than good by rendering the surface of the soil compact and hard, and preventing the admission of either heat or air.—*Moss. Ploughman.*

Technics of Forestry.

By J. CHARLES KING.

No. III.

(*Continued from page* 475.)

It may be thought by some people to be of little consequence how an axe, chopper, or bill is shaped, so long as it cuts: to a slovenly workman, or one whose only aim is to get through a day's work somehow, indifference is paramount; but to a thorough workman who is proud of his craft and the fulfilment of his duty to his employer, his tools and their fitness for the work to be done is a chief consideration, his extra trouble and added cost of tools are quite secondary matters.

I can recall with pride and pleasure the remembrance of sharing the work and forethought with such toilers in the forest. Theirs was the honesty of a sense of duty, not the "honesty is the best policy" motive. Their honesty, irrespective of policy, made them disregard the cost of the best tools, occasional delays, and long toiling walks through sludge and snow, to do their work timely, fittingly, and thoroughly. Their success was repaid in more ways than the one of mere wages, for they made their toil lighter. Who that has worked a long day in the forest does not know how an awkward, unsuitable tool tries the toiler's frame, more than a handy fitting tool does? The tool that is heavy for the work, or awkward for the user, may and does miss its stroke, and mars its user's purpose every now and then; it is not the fair cuts that try the worker's strength, but the misses that wrench him across the loins and in the shoulders; and when the work is done with bad tools, the job is a botch, about which a sloven does not care, but which a true workman would feel ashamed to own was his doing.

Having seen such bad work done with unsuitable tools, and for such work, having heard excuses as shallow as if policy without honesty was the motive for it, is the reason why I dwell upon this topic, so essential to the owners of forests as well as the forester.

Take the cuts of a bill used by a woodward at 7000 daily, with the force of three pounds for each stroke; this shows an accumulated weight of nearly 9½ tons. This force has to be adjusted so as not to strain the thumb or wrist, which a bad cutting and awkward handling bill would do long before this force was exerted; the consequence is a

tired worker before the day's work is half got through, and work so badly done, that for some special forest work, as felling trees bunglingly, its evil effects may be noted here and there in forests half a century afterwards, by the ruined "stubs," with but half-developed timber of sickly growth, or of other trees standing nigh with limbs torn off, that stood out of the way of the falling timber, only that bungling work made it fall on to them.

When I shall be able to place before your readers illustrations of the diversity of axes in use for various purposes of wood-craft, of which I have by working experience tested the relative values, it will surprise those who think any tool will do to use if it will chop wood, to learn that a woodward's heavy axe is of no use to the shipwright, that the coachmaker would not use a wheelwright's or carpenter's axe, though working in the same shop, and that the cooper uses an axe that all would look upon as worthless, and the lath-render's chopper would not be recognised as such by any other of these workers: yet each is so fitting for its special purpose.

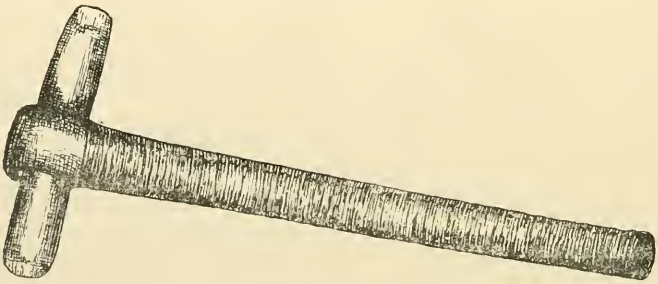


Fig 5.

In reverting to the consideration of the first form of axes in use—the axes of stone—we notice the same diversity; this matter has not had the attention the subject deserves, from the fact that the writers upon pre-historic tools are chiefly only book-makers or *dilettanti*. To the workman, the form of the tool would indicate the work done with it. The same technical ignorance pervades the illustrations of our histories and encyclopædias, more especially Biblical illustrations where I have seen pictures of a workman's axe resembling a crescent-shaped cheese-knife with an elegantly turned handle, like a bedpost or table-leg.

In the oldest axes known, made out of flint—a mere wedge of stone—ground to chisel edge, we note the absence of any hole or eye for a handle; we at once know that the handle must have encompassed the axe-head, the same as a smith's hazel-rod does his chisel, somewhat like the sketch Fig 5. The stone axe-heads are nearly always rounded off at the edges, to admit of a split sapling or shoot being doubled round it and lashed together along the handle, additional

firmness being no doubt given to the head-fixing by the use of adhesive resin or lac, the same as is used by savage tribes at the present time.

In this matter it is noticeable how technics works roundto their starting-points. The most improved American mattocks and pick-axes, for some purposes, are made for the head to slide into the iron socket of the handle. Our cousins patent this old device as a new invention, and handicap their toil by the extortion of royalties, and fees by useless patent-agents, which their progenitor axemen would doubtless, in their barbarous ignorance, have thought anything but right.

The use of the saw for felling timber is yet hardly known in some of the northern and western counties of Great Britain and Ireland, though obviously so expeditious and economical. It is therefore for the foresters who may think the axe is the best to fell big timber, or for such as desire to use the saw instead, that I briefly describe its use.

The saw used is generally an old pit-saw, five or six feet long, with gullet-neck teeth, and with plenty of "set" to them, to let the saw-blade clear the cut easily: two welded together are used for large trees. An upright handle, at right angles to the blade, is bolted with two bolts on to the large end of the saw—this is for the draw-back stroke, and one man only at this handle is sufficient for ordinary timber. At the small end of the saw is a hole, with an iron ring about 2½ inches diameter; to which a piece of cord is tied. The method of procedure is the same as for axe-felling, so far as planning the direction of the fall, clearing away the ground with spade and mattock; the claws and bole of the tree are cut round level with the circumjacent ground, so as to give free action to the saw and workers' hands.

The saw-cut is made quite close to the ground, as every inch of timber left on the ground is waste to the owner, and injurious to the growth of shoots for such trees as are meant for stub growth afterwards, as will be explained hereafter. The cut is kept perfectly horizontal throughout. One man at the handle, kneeling to his work, draws back the saw; the others at the rope, either kneeling or sitting, do the cutting. When about one quarter cut through, the iron wedges are lightly driven in; this, woodwards used to the work know, is only precautionary to prevent the closure of the cut by the weight of timber, or in case of its being a hollow shell to prevent the saw being suddenly nipped in the cut.

The saw is occasionally greased or oiled. When half cut through the number of wedges are increased and driven well into the cut; when nearly through, a hardwood wedge is used sometimes, which will raise the timber so as to direct its fall to clear other timber; one

slight impulse to the wedge will topple over the tree with a crash, so familiar to woodwards, but so startling to an onlooker for the first time, who finds himself in a shower of dust and splintered branches that fall harmlessly around him; in the midst of a din and shock that makes the ground tremble beneath his feet, the growth of perhaps three or four centuries lies prostrate. The woodward glances at the exposed end and sees its condition as to soundness, perhaps could tell you, within a foot, its cubical contents—"round measure." If he sees five or more radiating brown lines from the heart to the bark, he shakes his head and mutters, "Firewood!" These marks are sometimes shakes caused by the tree being smitten by lightning, rendering it almost useless except for firewood or fencing purposes. For the benefit of any forester who may think the primitive method of axe-felling a large tree the best, I will point out the technical disadvantages to the forest owner, and absolute loss of valuable time and of timber by waste, and lessened measure of the most useful part of a tree chopped down.

By axing down a tree, the chopping begins from six to nine inches above the ground, working obliquely downwards, at about an angle of 35 degrees, so that when the tree falls, it presents to view a conical end, which part is quite worthless, and never reckoned in measure by a buyer; yet on a tree nine feet diameter, chopped nine inches above the ground level, and reckoned as a cone of that depth, the loss would be nearly sixteen solid feet of good timber to the owner; this at only 2s. per foot is £1 12s. wasted. Now for the harm done to the stub if left in the ground for future growth of timber. The liber of the bark edges of the alburnum or sapwood have been hacked, and to some extent shattered by the blows of the axe; the finer fibres of the roots or sponglets have been ruptured, checking growth for a time; a wooden basin has been made, into which the wheels of the "gig," or timber carriage, jump in and out, breaking the coronet of bark round the hole, which should be protected for germinating future growth. A flat table-top, sawn stub, is firm and smooth for men, horses, wheeled vehicles passing over, or sliding other timber over for years.

In my first essay I mentioned electricity as a motor for forest tools. I can only now briefly allude to the wonderful invention of Heinrich Stapfer, of London, by which the most delicate operations of surgical dentistry are painlessly performed, as well as the felling of trees, under-cutting coal-seams, or quarrying stone, at very little cost. Its speciality in forest work will doubtless be in trimming and pruning large trees from the ground, without having to climb the tree to use the saw or axe: always a risky and unsatisfactory job for both woodward and overlooker.

Estates Management.

In bringing this subject under your readers' notice it is not in the meantime with the intention of taking up and dealing in an exhaustive manner with any particular branch or department of so wide and comprehensive a subject. It is more the writer's aim simply to call attention to Estates Management as distinguished from the forestal department thereof.

I have read with much interest and pleasure the pages of the Journal since its commencement, and have marked with pleasure, and indeed some degree of surprise, the amount of practical and literary culture displayed in some of those vigorous and interesting articles from the pens of foresters, land stewards, &c.; at the same time I am confident I only express the feelings of the majority of your readers when I say that the success of the Journal has hitherto been, and in future will (to a great extent) continue to be, dependent on those men of science, literary culture, and large experience of subjects connected with forestry, the management of landed property, &c., whose valuable contributions have already, and may in future, adorn its pages. It is also to be hoped that all who are in any way interested in the above subjects will make every effort to promote the usefulness and extend the circulation of the Journal, which, like many other publications of a kindred nature which have risen to eminence, and secured a firm and established footing in the literary world, will require in its infancy a certain amount of fostering care, to enable it to take its place among other representative journals of the day with credit to its enterprising publishers, and that large and influential class whom it more or less represents.

To return to my subject, after this somewhat lengthy digression, allow me to say, that in perusing the pages of the Journal I observe that few of those branches of estate management which more immediately fall to the care and superintendence of the agent or land steward have been noticed or discussed. I may be told, on the other hand, that little time has yet been lost, that the Journal has not been so long in existence, and that some of the subjects already brought forward have not been thoroughly ventilated or discussed. Admitting all that to be the case, it seems to me that were some of your able

and experienced contributors to give us a few remarks on something foreign to arboriculture in the literal sense of the term, and yet within the limits of estate management, they would lend a degree of variety to the pages of the Journal which would, I am sure, be much appreciated. For instance, an article on the erection of farm buildings, cottages, &c., could not fail to be deeply interesting to many of your readers, especially those on whom the expense and superintendence of such occasionally devolve. The rapid advance of agriculture, and the requirements of the age, demand for the farmer more extensive and much more convenient accommodation for himself and family, as well as for the labourers whom he employs, to say nothing of the highly bred stock, and expensive machinery and implements, for which he must find proper accommodation if he expects to succeed in modern farming.

The improvement of farmhouses and buildings, and the often half-ruinous and uncomfortable cottages inhabited by estate and farm labourers, have for many years engaged the earnest attention of proprietors, and those acting for them; so much so that in some counties of Scotland a sort of rivalry seems to exist among the proprietors as to who shall have the best farm buildings suited to the size and requirements of the farm, and the neatest and most comfortable dwellings for those whom they employ. I am sure the Editor would endeavour to find space for a plan, on a small scale, of a farmhouse, offices, or cottages, which might be accompanied with a short but concise specification for the same. This would afford considerable scope for discussion, which would prove of mutual advantage, and thus a large amount of useful information would be elicited. It may be argued, as architecture is a distinct profession by itself, that every man ought to be allowed to live by his profession.

While to some extent admitting that argument, we at the same time cannot ignore the fact that some of us are expected by our employers to be able to prepare plans and specifications for farm buildings, cottages, &c.; in fact, this is now considered an indipensable qualification in any man who aspires to the management of landed property, whether it be as agent, land-steward, or overseer.

The push and competition of the times necessitate the adoption of every legitimate means to attain and hold a position in the world, even though they may trench on the occupation or professions of others. At the same time, architects, as a body, do not view our encroachments with much concern, our efforts being chiefly directed to that class of work which is not altogether the special delight of the members of that honourable body.

Articles on draining of arable and waste land, on laying down of permanent and other pasture, or, indeed, any of the numerous

subjects connected with agriculture and agricultural operations, would all offer scope for discussion, and be most interesting and acceptable to the readers of this Journal.

A. B.

[We heartily endorse our contributor's remarks and suggestions and will be pleased to receive from him and others suitable contributions on any subject connected with Estates Management.—Ed.]

A few words in honour of the English Elm.

Most of your readers will no doubt consider it presumption on the part of an agent's wife to occupy your space with any remarks on *masculine* subjects, such as the one I have chosen for my heading.

I take a great interest in the art of forestry, and from the starting of your excellent Journal I have felt a desire to contribute some random thoughts, to show your numerous readers that we of the fair sex are not all indifferent to the claims of forestry as a national science. First, then, let me ask your contributors if none of them have a word to say in praise of the elm. The oak has been lauded beyond measure, and I grant it is worthy to be termed the "monarch of the forest," &c., &c., but cannot beauty be seen in the graceful elm, with its towering head defining the outline of so many fields which are embellished with hedgerow timber? Many of those who during the past season have enjoyed the luxury of a drive in the four-in-hand from Hyde Park Corner to Southampton, must have been struck by the beautiful effects produced in lanes, fields, parks, and pleasure-grounds by the stately elms. While driving along the base of Box Hill from Leatherhead to Dorking, nothing can surpass the beauty of that remarkably picturesque road, the winding outline of which is so clearly defined by the elegant, light, and almost brilliant foliage of this handsome tree. The elm hedges, surmounted by stately trees, seem to form a wall of foliage, which is in happy contrast to the various tints of ash, beech, birch, and firs, with occasional cedars interspersed between. Looking from hill to hill, and seeing all these varied shades, with the beautiful elm standing so light and graceful in the landscape, it seems to me in the autumn season the most beautiful of trees. We who live in sunny Surrey have the advantage over many of those who dwell in neighbouring counties, for we have so many undulating hills and lovely vales, that the varied tints of beautiful foliage show themselves to the greatest perfection. The bronze-coloured oak, the graceful birch, and the light-tinted elm, with the sombre firs, form such a beautiful landscape as is worthy the canvas of the most famous of painters.

Mab.

Advantages of Early Planting.

By D. T. FISH, Hardwicke, Bury St. Edmund's, Suffolk.

These may be briefly summarized as including more time, more work, more heat, more growing force, and in consequence a larger percentage of success. It is obvious that the early planter has more time for his work than the late planter. Beginning towards the end of October he may continue planting till February,—not that such an extension of the planting season into the new year is desirable. But he can afford to go about the work in a more leisurely manner than he who defers his planting till the new year. It is then too often done in haste, and without that due regard for thoroughness which ought to distinguish such a solid and lasting operation as that of the planting of a tree for life. "Marry in haste, repent at leisure," is equally applicable to the planting of trees. Spurts are allowable at the oar or on the course, but trees planted in spurts mostly perish in the most leisurely and provoking manner. The early planter has also the selection of time in his power. It is an immense practical advantage not to be obliged to plant in unfavourable weather. The early planter may plant when it suits him or the trees; the late planter, who has much to do, must plant be the weather and soil what they may. Trees should not be planted in mud, nor during sharp frosts, nor drying easterly winds. The first swamps or rots the roots; the second paralyze their power; and the last dry up the larger part of their vital juices. By starting early, making every possible preparation beforehand, and promptly seizing every opportunity that offers, the early planter will generally be able to keep abreast of his work and complete his planting in good time, and in the surest manner to command success. The command of the old Earl of Haddington, on his-death bed, to his son John, to "be aye sticking in a tree, Jock," has done perhaps as much harm as good. For while it cannot be doubted it led him and many other Scotch lairds to plant extensively, it likewise gave rise to much careless and slovenly planting, which was fruitful of many deaths and preposterously slow progress. Planting should be something more and better than the mere sticking of trees into the earth anyhow and almost at any time. The time is, in fact, a powerful factor in the operation; and the six weeks included

in the last half of October and the whole of November, is without doubt the most advantageous season for planting.

The idea that the stars in their courses fought for or against the ancient warrior was as beautiful as it was sublime. That, however, was but the offspring of fancy or the creation of poesy; but it is a sober fact that the sun himself is ranged on the side of the early planter. The earth is still fairly stored with solar heat through October and November. Heat is the most active recuperative power in nature. Instinct and experience alike prompt us to keep our wounds warm. If we cut our finger, we wrap it round with rag, not merely to exclude the air, but to retain the heat. If anyone doubts that the heat is an element in the healing, let him try the experiment of exposing his next cut to the cold. He will not repeat the cold cure for wounds. The same care holds good with plants. Each newly planted tree has received some, it may be many wounds. It is impossible to transplant trees, however small, without mutilating or bruising few or many of their most delicate roots. The primary object of the planter is to get these wounds healed as quickly as possible. There is no healing power within reach equal to a covering of fine—that is, close-fitting warm earth. Treat the roots to this promptly, and they begin to heal at once; and once the start is made the process of healing is soon and surely completed.

Trees are necessarily detached from the soil in the process of replanting. The old connection is severed, and a certain time must elapse before a new one is established. True, the roots are covered with earth, but this covering is merely mechanical, and the roots have no vital hold of the ground; they absorb neither food nor water from it. This interregnum in the close hold of the roots on the soil constitutes the danger of planting. While the roots remain detached the plant suffers in health and strength—in fact, is in danger of dying. Hence the practical importance of making the period of detachment, or root isolation, as short as possible. Solar heat is the great root-quickener that arouses them to a sense of their new position, and enables them to lay hold of and grow in the fresh soil of their new abode.

But supposing the solar heat to be flooded, frozen, or driven out by the cold rains, frosts, snows, or winds of winter, the injured roots will be deprived of their most powerful healer and only available stimulant to their speedy settlement in their new home. This is no matter of theory, but of actual experience and daily observation. Plant trees at the seasons here specified, the roots heal quickly and take a grip of the soil at once. Defer planting till January, and the roots start slowly—often not at all in time to recuperate the trees, exhausted of their fluids by their bursting buds in the early spring.

This brings us to the third point in favour of early planting—more growing force. The roots are more active in the late autumn or early winter than at any other season. Few that have had much experience with trees or shrubs but must have noticed this. Lay trees in by the heels in November, and they will form a mass of new roots in a month or six weeks. Lay the same trees in during January, and nothing like the number of roots will be formed. An examination of trees planted at the two seasons respectively reveals similar disparity of root action at the two seasons. The cause of this may arise from the descending sap, if there is such a thing. Or perhaps, more probably, from the residue of solar heat still stored within the fertile bosom of the earth. Probably, also, the winter is the special season for root extension. During the summer, with the trees covered with leaves, flowers, or fruits, it may very well happen that the roots are chiefly engaged in forwarding supplies. Like parcels delivery companies, they may then receive for and deliver to other parts of the plants chiefly or only. The season of falling leaves, and naked boughs brings a partial rest or slackness in the collecting and delivery departments. What, therefore, is more probable than that this should be the season chosen by the roots for enlarging themselves, and breaking into new ground against the augmented demands of the next season. Be all this as it may, it is certain that during November the roots of deciduous trees are in a state of abnormal activity, and the prudent cultivator will gladly avail himself of this augmented vital force as the most potent means at his disposal for promptly starting his trees in their new positions.

The early planter also gets more work done than the late one. Work here has also a double meaning. It is true the early planter gets more trees planted for less money than he that plants later. This is something, for planting is costly if well done, whether on a large or a small scale. But the trees themselves do better if planted early,—and this is of the utmost moment. Trees thrive or stunt, live or die, very much in the ratio of the promptness of their root-making within the first two months of the time of their planting. Plant in November—the roots will be in full growth before January, and the tree be safely established,—plant in January, and the condition of the tree in March—the most trying month of the whole year—may be said to be at the mercy of a chapter of accidents, on which no one can rely with any certainty.

If there is any truth in these remarks—and no planter will deny that there is much—one last proposition follows as a matter of course, that the early planter commands the larger measure of success. This is abundantly proved by experience, the outcome of which may be summarized thus:—Plant early, the trees *must* thrive; plant late, they *may* live.

A Tour through the Woods and Forests of Duff House, Banffshire.

(*Continued from page* 488.)

CONTINUING our walk by the winding river, and favoured with a beautiful day, we on the one hand cannot help admiring the beautiful surrounding scenery, and on the other stopping to examine some grand living monuments of the vegetable kingdom in the form of beautiful silver firs (*Picea pectinata*). Many other good specimen trees of elm, lime, and poplar, adorn this river-side, but it would seem that the silver fir reigns paramount.

We came upon the root of one recently cut, and were informed that it was blown over in a gale of wind. The felling and lopping of the tree were simple matters compared with its removal, owing to its enormous size. However, it had been allowed to lie by the river-side until the first spate, when it was successfully floated down to the Bridge of Banff, being nearly a mile from where it grew. The solid contents of this splendid tree were 210 feet.

A good many more of the same size are still existing near by; consequently we were induced to take the dimensions of two of them, which are as follows:—No. 1, circum. of bole at 5 ft. from the ground 10 ft.; entire height of tree about 100 ft. No. 2 measures at 5 ft. from the ground 11 ft. 1 in. in girth, length of bole 27 ft.; it then ramifies until it forms a fine head about 90 ft. high. These are about an average size, and by their dark evergreen appearance, contrasted with their deciduous neighbours, give at all times a pleasing effect to the sloping sides of the winding river.

Opposite to where we stand, and near the middle of the river, is a well-wooded island, containing some very fine specimens, but we must allow them to remain without further note, having no taste for fording the river, and possibly disturbing the salmon, which at this season reigns supreme in these waters. By the side of the walk is a beautiful spring, known as St. Mary's Well, the water of which is always cool and limpid, and, to the favoured in search of the picturesque, is, in summer time, a refreshing draught;—

"Its placid waters, O how cool and clear!"

A little further on and we observe a recently planted cedar of Lebanon (*Cedrus Libani*), growing beautifully, and we presume that at

no distant day its natural grandeur and beauty will forcibly remind the traveller, as he passes along, that this is the famous tree of ancient Lebanon, celebrated in Holy Writ, giving it an interest surpassing all others of the coniferous family. We next come to a fine specimen of the white willow (*Salix alba*), but now showing symptoms of decay. Its dimensions are as follows:—Circum. of trunk at 5 ft. up, 12 ft. 9 in.; length of trunk 14 ft., above which it forms a majestic head. This tree, with its feathery foliage showing a silvery tint with the slightest ruffling of the breeze, makes an elegant and imposing object in forest scenery. A little further on we come upon the estate saw-mill, driven by water-power from the river, and devoted exclusively to the manufacture of timber for estate purposes.

Around this, and by the river-side, we observe a thriving young hedge of beech, and another of thorn, in which are planted several fine scarlet oaks (*Quercus coccinea*), all being surrounded by a neat wooden fence.

We now leave the side of the river, and retrace our steps, when we soon find ourselves at the entrance to the Pinetum, in which are some very good specimens. To enumerate all the different kinds would take up too much of our time and space, so we content ourselves with the dimensions of a few. The first we met was *Picea pinsapo*, a peculiar looking tree, with its foliage dense and short, very handsome indeed. Next, is a fine specimen of *Abies Menziesii*, the circum. of bole at 5 ft. from ground 3 ft. 10 in., diam. of branches 36 ft., with a height of 40 ft. No. 2, standing near by the last, measures at 5 ft. up, 3 ft. 7 in.; diam. of branches 34 ft., height 38 ft. These are two beautiful specimens, with their sharp and silvery leaves turned in every direction, and with numerous cylindrical cones from 2½ to 3 in. long, fairly well filled with its small seed. Next come two good specimens of the *Abies Douglasii*, the circum. of trunk of No. 1 at 5 ft. up is 2 ft. 6 in., diam. of branches 19 ft., height of tree 32 ft. No. 2 is at 5 ft. from the ground 3 ft. 8 in. girth of stem, diam. of branches 39 ft., height of tree 30 ft. Altogether both *A. Menziesii* and *A. Douglasii* are fine specimens. Conspicuous among all stands *Picea nobilis*, studded with numerous clusters of large cylindrical, sessile cones, almost tempting us to put forth our hands and pull forbidden fruit. It was a grand sight to see these fine clusters of cones, each from 6 to 7 in. long, and from 8 to 9 in. in circum. on the lateral branches, with their thickly set leaves in two linear rows, and beautiful silvery-like appearance beneath. Next is a very fine specimen of *Cedrus Libani*, with its beautiful leaves and solitary cones from 3 to 5 in. long. We think that such trees as these planted on a lawn must confer dignity on the adjoining mansion; indeed, even here, growing beside a few of *Cedrus deodara*, we thought that their

grandeur was unrivalled. We next observe *Pinus Pinaster*, with a few beautiful cones about 4½ in. long and 3½ in. in circum., the colour of which seems to be an intense purple. There are many more nice specimens, which deserve to be noticed did space permit. We much regretted to see the squirrel making such havoc amongst the handsome cones, especially those of *Picea nobilis*. Continuing our walk by the carriage drive, nothing of special interest occurs until we reach the mausoleum. It is a neat erection in the Gothic style of architecture, surrounded with numerous shrubs, among which may be seen the "cypress and the yew's funereal shade." The windows are in casements of stone and filled with stained glass. In front are placed two beautiful statues emblematical of Faith and Hope. Altogether this place forms a striking ornament to the spacious park.

A little farther on and we come to a small hill covered with shrubs of different kinds, at the bottom of which are several very fine silver firs, equal to those already mentioned, while on the top is erected a small semicircular house or cottage. Tradition says that on this mount King Robert the Bruce received the homage of his subjects, and that the Carmelite friars induced those under their religious discipline to carry so much earth every day to form it as a penance for offences against the seventh commandment, and other peccadilloes. Be this as it may, there it stands, and at its foot we heard a very interesting discussion on the subject of pruning timber, which we are not likely soon to forget, but as the shades of evening were closing around us we had to seek shelter elsewhere, resolving to meet again on an early day.

D. S. J.

(*To be continued.*)

Public Park for Wishaw, Lanarkshire, N.B.—The thriving and populous town of Wishaw and its vicinity have been supplied with a handsome public park, through the generous liberality of a neighbouring landed proprietor, J. Houldsworth, Esq., of Coltness, who, in addition to presenting the ground, has spent fully £2,000 in laying it out and making it suitable for the purpose intended. It is beautifully situated to the east of the town, at the foot of the rising knoll on which stands the parish church of Cambusnethan. It extends to eight acres, and is being laid out and planted with much taste; convenient roads and walks running through it, and trees and shrubs of an ornamental character being freely introduced and judiciously arranged.

Planting on Hard Ground.

By ANDREW SLATER, Wyreside Cottage, Lancaster.

Now that the principles of planting have been laid down in the Journal, it would perhaps not be out of place to give a few remarks on a system adapted for planting on ground of a nature that may be too hard for the insertion of a spade. Those who may have had to conduct planting operations in hilly districts will, at times, have found a difficulty in having the plants inserted so as to insure success, owing to rocky *débris*, and the shingly nature of the slopes and valleys.

A system of planting, termed "crowbar planting," has been adopted for over the last twenty years on some estates near Llangollen and up the valley of the Dee, and it has been found to answer successfully on the hill-sides and stony ground of that district.

The bars in use are about three feet nine inches long, by about two inches square at one end, and drawn out to a sharp point; the upper half is of round iron, and rather smaller. Each planter is provided with a bar, and should be accompanied by a boy for carrying and inserting the plants. The operator strikes the implement into the ground to a sufficient depth, and gives it a jerk in each direction so as to widen the hole as much as possible; the boy has the roots of the plant gathered in his hand, and immediately the bar is withdrawn he drops them carefully into the hole and presses the plant down to its proper depth; it is then firmly tramped round with the heel, but if the ground be too hard the implement must be brought into requisition, and the edges of the hole punched in and firmly fastened round the neck of the plant. One man and a boy if used to the work, and the ground at all favourable, will plant about one thousand plants per day.

On first hearing of the above system I was rather sceptical as to the after success of the plantations so formed; but having occasion to be in the neighbourhood mentioned, I had an opportunity of looking over some of them, and I found that they had done well and were thriving wonderfully, considering the hard and shingly nature of the ground. Although I did not see any that had been recently planted, I am inclined to think they would take a few years to start away freely, owing to the roots being confined so close together, and the hardness of the sides of the holes caused by the action of the bar, requiring to

be penetrated by the roots before a sufficiency of nourishment could be got for their proper development.

The only other method that would be applicable in most instances for these localities would be pitting, and that would entail considerable expense, and there would be the impossibility of getting the trees properly fastened, unless there was a supply of soil at hand; there would also be a greater part of the surface broken up than by bar planting; there would consequently be a greater risk of drought penetrating to their roots and destroying the plants. In a conversation I had with a landed proprietor who had planted pretty extensively, he said it was the only method of planting that had been adopted on his estate for a number of years, and as he found it successful, he intended to try no other.

Since penning the above I have had a letter from an estate manager who has had considerable experience in planting with the crowbar, and he testifies to the success of plantations formed in that way.

Large Tulip Trees.—There are several majestic tulip trees growing at Longleat, Wiltshire, the largest of which is close upon 100 feet high, with a fine round solid bole 15 feet long, and 10 feet in circumference at 5 feet from the base. Another fine specimen is about 85 feet high, with a straight bole 10 feet long, and 10 feet 10 inches at 5 feet up. At Zeal's House, in the same county, is a magnificent tulip tree in luxuriant health, the height of which is fully 60 feet, and the diameter of the spread of the branches is about 70 feet; the bole being 6 feet long, up to where it divides into several huge handsome limbs, and 13 feet 4 inches in circumference at the smallest part. The largest of several fine tulip trees growing in the pleasure grounds at Margam Park, Glamorganshire, is 13 feet in circumference of stem at 3 feet from the ground, and nearly 100 feet high. A grand old tulip tree, one of the largest in England, grows within 20 feet of the mansion-house at Killerton Park, Devonshire, the seat of Sir Thomas Dyke Acland, Bart. Its height is about 90 feet, the diameter of the spread of the branches being 70 feet at the widest part; the bole is 12 feet in length to where its massive limbs fork off; and the smallest girth, which is about halfway up the bole, is 14 feet. It is annually covered with a profusion of its tulip-like flowers, and the bark has a rough corded appearance, which is very ornamental.

Fencing for Woods.

Any one with merely a slight experience in fencing for woods must know the many objections to wooden railing, mainly the expense and the want of durability. I have lately come across two kinds of fencing, each of which has its advantages, and which I will briefly describe.

The one is a wire fence of American origin, called the "Barb Fence," so named from the barbs or spikes fixed on it at intervals of some six inches. It is a twisted wire of two strands, having a short bit of wire twisted at right angles round one of the strands forming two sharp spikes, the transverse wire being kept in its place by the second wire strand being twisted round the first. The wire is sent out in coils from the manufacturers round a rough wood framework, which is inside, the spikes being exposed *en route.*

The advantages claimed for the barb fence are these, that though made of steel wire, capable of resisting a strain of from 1,200 to 1500 lbs., still, owing to the barbs, strength is not required, as cattle having once come in contact with the wires give them a wide berth ever afterwards. Any one conversant with wire fencing knows that the main danger of breakage is owing to the beasts shoving their heads and horns through the wires to eat the grass within a couple of feet of the fence, they then get fast, and either break the wires, pull out the staples, or loosen the stobs. This, with the barb fence, no animal will do. At the same time the spikes are so short, that though they will prick severely, still they will do no real harm.

The makers claim that three wires will be as effectual a fence as six lines of common fencing—certainly four lines would. The wires are fastened with staples to the usual stobs, and cost 12s. 6d. per 100 yards. Thus supposing four lines used, they would cost for wire 6d. per yard. The makers of the barb fence are Messrs. R. Johnson and Shepherd, Bradford Iron Works, Manchester.

The other fence that I have erected is a combination of iron and wood. Iron uprights and stay bolts made of angle iron, thus ┐, with holes bored in one side, in which are inserted iron loops to support wood rails.

The rails are 4 in. × 1 in., therefore the loops must be sufficiently large to embrace them, and be screwed by nuts to the uprights. There is an iron stay to the upright with a flat foot, which supports

it on the inner side next the wood, making the fence exceedingly stiff and firm. The whole fence is easy to erect, and can be taken down, removed, and re-erected in a fresh place in a few hours. If the iron be well painted at starting and kept so, it is practically imperishable. In my case the rails were of the best foreign timber, cut to the proper lengths at the wood yard, but good larch would perhaps do as well. The rails are spliced at the loops, not more than two of the four meeting at the same post, The cost of this fencing varies with the price of iron, but would not be above 1s. a foot, including stay with foot-plate. This is a very strong, useful fence, especially where it is desirable to remove it after a few years.

It has struck me that these two fences combined would make a perfect and everlasting fence. Fix your uprights (and much lighter ones might be used for bearing the barb fence than the wood rails) with holes in them for staples, which would have to be made of soft iron capable of being bent into the holes after the barb fence is laid up to it, as, owing to the spikes the wires cannot be stretched through holes. When the ends of the staples are drawn through the hole with pincers they would have to be turned back to form a kind of rivet. The wire merely wants supporting, as the fence being placed against a wood, the cattle come against it on one side only, and in fact dare not touch it for fear of the barbs.

The iron uprights, with barb fence of four lines attached, would last a lifetime, and would not cost more than 1s. a yard.

Flasby, Yorks. J. N. P.

The Compass Plant.—It has long been known that the Western plant growing on the open prairies of America, and known as the *Silphium laciniatum*, has the property of turning many of its leaves nearly north and south, and hence the name "compass plant." It is also called "rosinweed," from its copious resinous juice. In order to determine to what extent this alleged popularity exists, C. E. Bessey, of Auves, Iowa, has, says the *Scientific American*, made a large number of accurate observations, which he reports in a late number of the *American Naturalist*. Out of ninety-three observations, fifty-four were found which pointed more or less east of north, and thirty-nine more or less west. Of the fifty-four which pointed eastwardly, eighteen were within 5 deg. of north, eight more within 10 deg., seven more within 15 deg., five more within 20 deg., and three more within 25 deg., leaving only fourteen leaves which diverged more than 25 deg. from due north. Of the thirty-nine which pointed to the west of north, nine were within 5 deg., five more within 10 deg., three more within 15 deg., seven more within 25 deg., and seven more within 35 deg., leaving only eight which diverged more than 35 deg. from due north. Its popularity is fully established in America.

Indian Forest Management.

By D. SYM SCOTT, Ballinacourte, Tipperary.

Many readers of this Journal have probably read with interest the sensible remarks which have lately appeared on the conservation of forests in India, and as comparatively few understand what is meant by "Forest Department in India," a few remarks on the subject may command sufficient interest for British foresters to merit insertion in the Journal. Many probably know that an examination is held annually to select young men, above seventeen and under twenty-one years of age, natural born British subjects, to be trained as foresters for our Indian forests. Those found qualified are sent for two years' training to France. It must not be omitted here that it is a great recommendation if such applicant have had an opportunity of passing some time *probably not less than a month, with one or more approved Scotch forester.* The branches of knowledge required from candidates for appointment consist of the three "R's," algebra, geometry, freehand drawing, surveying, also some French; and a preference is given to those having a knowledge of the elements of mechanics, physics, chemistry, botany, geology, and mineralogy. The candidates accepted by the Secretary of State must undergo a regular course of training for *two years and a half in the management of plantations, the science of forestry, surveying, road-making,* and of course all the concomitants connected with forestry. All this is to be learned abroad at a cost, according to estimate, not to exceed £600. At the end of "two years" they proceed to India as junior assistants in the "Forest Department." Such being an outline of how Indian foresters are produced, I pause to contrast such a course of encyclopædic training with the thorough practical system followed out among home foresters. No doubt the training received on the Continent is theoretically elaborate enough in "fours right," "about," "left wheel," and "forward," for a picnic! technically called a "botanical excursion." No rule ever devised by man yet made a poet, so in kindred the influence of climate never will make a practical forester. I say *influence of climate,* for what amount of practical knowledge of the technics of forestry can, even with the acquisition of a *month* under a Scotch forester,

be acquired in "*two years*"? I am not underrating the young men's abilities, because many of them are gentlemen of good learning; at the same time a *bonâ fide* anecdote may here be told to show their limited knowledge of practical forestry. I was once favoured with a call from a number of these gentlemen, accredited with the "two years' training," and who were making a professional visit of inspection to learn the various British systems of planting trees before leaving Europe for India. They looked on for *three minutes* at us notching-in young Scots firs, and then expressed themselves thoroughly conversant with the operation. Doubting this, I took my spade, and resting it on a flat stone, asked them for the most approved Continental system of placing a plant there—in the centre of the stone as indicated with my spade. I was entertained with a dissertation on how the stone must first be covered with soil, and that to a considerable depth before a plant *ought* to be put in! I turned over the stone, and gravely remarked that *that* was *British training*. I am free to say none of the above aspirants could distinguish chalk from calcareous strata, and yet they were found qualified by the Secretary of State to act under superior officers as much acquainted with practical forestry as the *savans* of Savile Row are with the fauna of Lake Tanganyika.

The existing system of sending young men abroad to learn forestry for Indian appointments is just so much public money utterly wasted, directly and indirectly, through futile and ill-directed labour. The British forester enjoys facilities not yet extended to his Continental *confrères*, for he constructs bridges, erects fences of every kind and material, cuts drains and canals, quarries stones, builds houses, makes roads, rears trees and shrubs by all the best methods, plants, fells, and manufactures timber *ad infinitum*.

In advocating that home-trained men should be appointed for India, permit me to point out what influence man has upon climate. Twenty years ago the island of Santa Cruz was a garden of fertility, but some years since the forests were destroyed, and now desiccation has swept across the whole island, rendering it as barren as the seashore, a result attributed entirely to the destruction of the woods. Some recent experiments confirm this theory. Two points of observation were established for comparison, one in an open locality, and the other close to a clump of pine trees. The observations were conducted at stations only 330 yards apart, and yet the one at the wood registered 10 per cent. more rainfall than the other. It was also found that the air over the trees was charged with 10 per cent. more vapour than in the open plain. The temperature in the vicinity of trees is more genial than in the open.

Many strong arguments could be adduced proving how much man

can ameliorate the climate, and in a measure prevent such disastrous calamities as have been recently experienced in India. Such facts strengthen our assertion that the education for Indian forest appointments, as at present carried out, is simply a gigantic failure, which can and ought to be immediately corrected by the establishment of Forest Schools, and the thorough teaching of sound practical British forestry.

Trees in Towns.—At a meeting of the Manchester Field Naturalists and Archæologists' Society, at Handforth, a paper was read by Mr. R. H. Alcock F.L.S., on trees in towns. Mr. Alcock, who has paid special attention to the subject for a number of years past, and made many experiments in planting trees in close proximity to his mill, situated in the outskirts of the town of Bury, said that the tendency to attribute every failure in plant cultivation in towns to smoke involves a fallacy that wants guarding against. The rhododendron, for instance, grows very well in his neighbourhood, even in the most smoky situations, and without any particular care being taken about the soil that it is planted in, though, no doubt, care in this respect repays the cultivator. On the other hand, the rhododendron will not grow at Evesham, in Worcestershire, where the atmosphere is so pure and the climate so genial that the place has been called the garden of England. Again, the plane tree (*Platanus Orientalis*), has been represented as a good tree for towns, because it flourishes in Paris and London. But the latitude, rainfall, soil, and subsoil of Manchester are different from those of Paris and London, while the smoke and noxious vapours in London are as nothing compared with what they are in Manchester. Mr. Alcock has planted six trees of *Platanus Orientalis* and they will not grow at all. The different sorts of poplar have also been recommended. Experience at Bury has shown that they make very rapid growth at first, and then die. Mr. Alcock stated that he had at present a couple of black Italians, a balsam, and four or five abeles, which have all been planted within the last six years, and look healthy enough; but he knows from experience that they will shortly die, as he has already eradicated about two score of them. At Gatley, which is about the same distance from Manchester on one side that Bury is on the other, the poplar in all its sorts grows well; but the climate is quite different, and the flora on the Gatley side of the city altogether more rich. The state of Mr. Alcock's limes indicates perfect health, notwithstanding the unfortunate circumstances in which they are placed. On the Rhine this tree is cut, twisted, trained, and tortured in every possible manner to form the covered ways for the *wein gartens*, and yet it lives and flourishes, and is the favourite tree; although the plane grows magnificently, as at Coblentz, as well as the walnut and many other trees. The lime is a beautiful and hardy tree, and it will stand smoke and grow well in Manchester if it is properly planted. The author of the paper also spoke with confidence of the wych elm, sycamore, birch, horse-chestnut, and Turkey oak. He has grown three or four plants of the ash for about four years, and they seem to do well. The beech grows well, he has not lost a single tree during the last twenty-five years. There are many shrubby plants which will also grow well; Mr. Alcock said he had not seen the holly or the hawthorn mentioned in the newspapers, though they will grow anywhere. His experience of the laural is adverse. The laburnum grows well.—*Gardeners' Magazine.*

A Gigantic Silver Fir.

By THOMAS WILKIE, Forester, Ardkinglas, Inverary.

A majestic specimen of the silver fir, 115 feet in length, and 13½ feet in circumference at 2½ feet from the ground, showing unmistakable signs of decay (being quite withered a month ago), has been lately cut down here, though with great reluctance, as it was standing where a Pinetum is now being formed, and consequently had to be removed. Five of these monarchs grew in a row, and are all grand old picturesque-looking trees. The leaders were taken off this, and other three of those still standing, by a weak-minded individual while in their young state. They afterwards sent out strong lateral branches, though the whole of them ultimately formed leaders. The one just cut down had three heavy lateral branches or limbs, one measuring 72 feet in length, another 40 feet, and the third 22 feet, after the tops were cut off. The tree measured in the aggregate 446 cubic feet, being equal to $3\frac{7}{12}$ cubic feet of growth per annum, this amount being seldom exceeded. I had the root end dressed with a plane, and counted 126 concentric rings on it, thus proving the rapidity of the growth of the tree. Being grown upon rich alluvial soil, some of your readers may be anxious to know what could be ascribed as the cause of its decay. I may state what I believe to be the cause. Two large limbs, the largest and the smallest of the three, grew upon one side of the tree, the smaller one in a direct line above the larger, the latter being only 5 feet from the ground, and the former 30 feet. The trunk was shaken, cracked, or split to the opposite side from these limbs for 50 feet upwards, and extending from side to side of the bole at the root end. A fungus was traceable in the shake for 19 feet upwards with the naked eye, and might have been traced farther with the aid of a microscope. The shake, I believe, was produced by the twisting and swaying of the trunk during the time of strong gales of wind, the two limbs referred to acting with great leverage upon it. Even some of the roots in a parallel line with the shake in the trunk were also split, the split or shake in them being full of the resin from the tree. The tree being cut over low down, and not uprooted, prevented me from ascertaining whether any of the roots below the ground were rotten or not. I believe, however, some of them would be, and were the source from whence the fungus got into the bole. We may learn

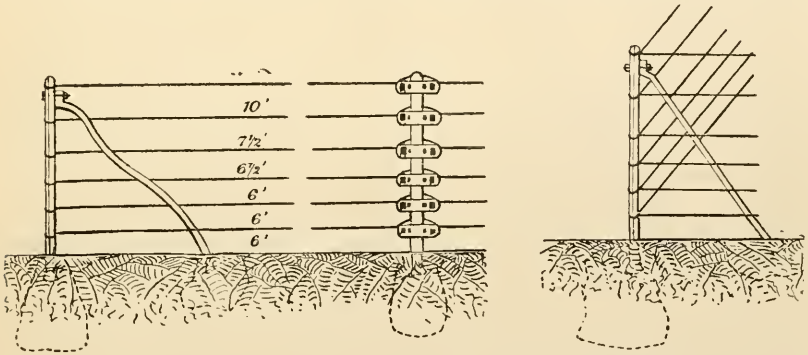
from the above that ring-shake or coult in trees is not always attributable to the soil, but often to the formation of the tree itself; hence the absolute necessity of cutting off during the earlier stages of the tree's growth all badly placed limbs likely to interfere with the leader or the proper balance of the head of the tree, as by so doing we would not only grow a sounder class of timber, but would also be the means of prolonging the life of many of our forest monarchs. Perhaps at a convenient time I may give you the dimensions, &c., of some trees of this description growing upon this estate, which are much larger than the one I have here described. [Please do.—Ed.]

The Trees in Sackville Street, Dublin.—Anent those forlorn specimens of plant life, "A Member of the late Botanic Committee of the Royal Dublin Society" writes:—"Now, as the trees in Sackville Street are about to be replanted by the great liberality of Mr. Niven, of Drumcondra, it might be well to consider the cause of the failure of the present trees. I told my friend Mr. Niven that I believed the chief cause was the position in which they were planted outside the edge of the flags—in fact, in a regular drain, as all the water and mud which runs along this drain pours down into the holes in which the trees are planted, keeping the roots in constant puddle and wet, and thus killing them. This was foreseen by many from the first. Now it is clear that they should be planted on the flagway—the trees planted along Wellington Road and the roads in the neighbourhood, as also in Leeson Park, and on the Thames Embankment in London, are all planted on the pathway; and they will fail again if not so planted. The other mistake was those huge heavy iron cribs that surround the trees in Sackville Street. Some iron merchant must have had a voice in the matter, who thought there was nothing like leather; their very weight helped to kill the trees. In all the places mentioned above, where the trees have prospered so well, wooden cribs have been used." Iron guards are generally used in the London metropolis, and their weight does not kill the trees, because, indeed, they exert no pressure upon either the stems or roots, from the manner in which they are placed. These trees are bedded in good soil; and if the Sackville Street trees were properly placed and bedded in good soil, and not nourished with street mud, they would be in a healthy state.—*Irish Builder.*

A Cheap and Substantial Straining-Post.

By D. SYM SCOTT, Forester, Ballinacourte, Tipperary, Ireland.

I am strongly in favour of wire fencing. I believe a well-erected wire fence will last upwards of twenty years without incurring much expense for repairs. But the difficulty is in getting them properly put up, the universal error is the want of being strained sufficiently to render them stock-proof. This error is mainly owing to the straining-post, wood or iron, not being securely fixed. As good fences are of paramount importance to field and forest, we should all assist and help each other in making known the best and cheapest methods of erecting really durable fences. I have already described how I fix wooden posts, and will now refer to iron ones. For a neat and substantial straining-pillar I prefer a solid iron bar, 1½ in. square, 3 ft. 9 in. above the ground. This is fixed into a boulder set on edge,



i. e., the longest way, with heavy end down, as shown in the figure The wires are only twisted round the tying-post, not through holes in it in the usual way, and winders are by a simple contrivance attached to the straining-post. Besides doing away with the necessity for drilling holes in the straining-posts, the wires can be put on at any gauge or distance apart. The rollers are attached to the post with two plates bolted on each side. Any foundry will cast the rollers at a trifling cost per 100, and the neighbouring blacksmith can do all the rest. The lockfast is held in position by its end being placed in slight indenture made in the post with a cold chisel. The stay is bolted through the post at the top, and should always have a separate stone from the post. Some prefer a bent stay, but a straight one will look quite as well, and resist a heavier strain. All corners should be tying-posts. I have used this sort of strainer for the past sixteen years, and have found it most efficient.

Superstitions and Facts connected with Trees.

It was customary among the ancient Romans to send boughs of holly during the Saturnalia, as emblematical of good wishes ; and the holly became thus to be considered as an emblem of peace and good-will. Holly appears to have been first used for the purpose of decorating sacred edifices at Rome, and the Saturnalia occurring about that period, it was the policy of the early Christians to assimilate the festivals of the pagans and the Christians as closely as possible in their outward forms, so as to avoid shocking unnecessarily the prejudices of the newly made converts. The Druids decorated dwelling-places with evergreen during the winter, that the sylvan spirits might repair to them, and remain unnipped with frost and cold winds, until a milder season had renewed the foliage of their abodes. The disciples of Zoroaster believed that the sun never shadowed the holly, and are said still to throw water impregnated with holly bark in the face of a child newly born.

Evelyn, in the first edition of his "Sylva," published in 1664, speaks of the laurel thus :—"This rare tree was first brought from Civita Vecchia, in 1614, by the Countess of Arundel, wife to that illustrious patron of arts and antiquities, Thomas, Earl of Arundel and Surrey." Evelyn adds that he cannot easily assent to the tradition, though he had it from "a noble lord," thinking it "more likely came from a colder clime." By the "History of the Arundel Family" it appears that the Countess of Arundel set out to Italy in 1614 for the purpose of accompanying her two sons to England, and as there are an immense number of very old laurels at Wardour Castle, Loudon, it is probable that the tradition may be correct. The case of Sir Theodosius Boughton, who was poisoned by laurel-leaf water, in 1780, by his brother-in-law, Captain Donaldson, who was executed for the murder, caused a great sensation at the time, and has rendered the poisonous properties of laurel water familiar to every one to this day.

Hawthorn flowers have been identified with the floral games of May and the beauties of spring from time immemorial. Their scent is said to be not only reviving to the spirits, but to have the power of counteracting poison. They are regarded as the emblem of hope, and were carried by the girls in the wedding processions of the ancient Greeks, and laid on the altar of Hymen, which was lighted with torches made of the wood. The Troglodytes tied branches of hawthorn to their dead. In France a bunch is sometimes placed in the

hat during a thunderstorm to guard the wearer from the lightning. The most remarkable legend connected with the hawthorn is that of the Glastonbury thorn. It is said that Joseph of Arimathea, after the burial of Christ, came to England, attended by twelve companions, to found the first Christian church in this island; and, guided by divine impulse, he proceeded to Glastonbury for that purpose. It was Christmas Day when he arrived at the spot where he had been commanded to build a church in honour of the Virgin Mary, and finding that the natives did not appear inclined to believe in his mission, he prayed to God to perform a miracle to convince them. His prayer was immediately answered; and, on striking his staff into the ground it immediately shot forth into leaves and blossoms. The legend adds that this thorn is still in existence, and still blossoms annually on Christmas Day. The French have a legend that, on the day after the massacre of St. Bartholomew, on August 25th, an old thorn in the churchyard of St. Innocent in Paris came into blossom a second time. The Greeks and Romans gathered the May in honour of Flora, to whom this plant was dedicated, and whose festival began on May Day; and the Greeks, even of the present time, preserve the memorial of this custom by hanging a garland of hawthorn flowers against their doors on the 1st of May. Stowe tells us that Henry VIII., with Queen Katharine, and the lords and ladies of their court, rode out a-Maying from Greenwich to Shooter's Hill; and in a curious MS. entitled "The State of Eton School," A.D. 1560, it is stated that "on the day of St. Philip and St. James (1st May), if it be fair weather and the master grant leave, those boys who choose it may rise at four o'clock to gather May branches, if they can do it without wetting their feet."

It is a curious fact that the apple tree is distinguished by legends in the mythologies of the Greeks, the Scandinavians, and the Druids. The pagans believed that the golden fruit of the Hesperides, which it was one of the labours of Hercules to obtain, in spite of the fierce dragon that guarded them, and never slept, were apples; though modern writers have supposed them to be oranges. In the "Edda" we are told that the goddess Iduna had the care of apples which had the power of conferring immortality; and which were, consequently, reserved for the gods, who ate of them when they began to feel themselves growing old. The Druids paid particular reverence to the apple tree, because the mistletoe was supposed only to grow on it and the oak, and also on account of the great usefulness of the fruit. Hercules was worshipped by the Thebans under the name of Melius, and apples were offered at his altars, and the ancient Welsh bards were rewarded for excelling in song by "the token of apply spray." On Christmas Eve the farmers and their men in Devonshire used to take

a large bowl of cider, with toast in it, and carrying it in state to the orchard, saluted the apple trees with much ceremony, in order to make them bear well the next season. The song with which the apple tree is saluted is thus given in Hone's "Every-day Book:"—

"Here's to thee, old apple tree,
Whence thou may'st bud, and whence thou may'st blow,
And whence thou may'st bear apples enow.
Hats full! caps full!
Bushel—bushel—sacks full!
And my pockets full too,
Huzza!"

In Brand's "Popular Antiquities" the following is stated as another mode of performing this charm:—The farmer and his workmen go out into the orchard, after supper, on the eve of Twelfth-night, with a large milk-pan full of cider, having roasted apples pressed into it. Out of this each person in company takes what is called a "clayen cup," that is, an earthen cup full of liquor; and standing under each of the most fruitful of the apple trees, and passing by those that are not good bearers, he addresses it in the following words:—

"Health to thee good apple tree,
Well to bear pocketfuls, hatfuls,
Peckfuls, bushelbagfuls."

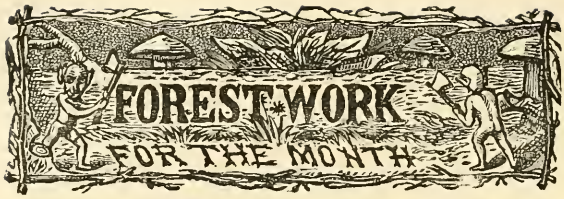
and then drinking a part of the contents, he throws the rest, with the fragments of the roasted apples, at the tree. At each cup the company set up a shout. There are also numerous other customs connected with apples, which there is not space to notice here, but for the most part they will be found in the above-mentioned works.

Concerning the ash, Virgil mentions that its fruit was considered as sure to attract the thrush and blackbird to any grove where it grew. In more modern times it was considered a preservative against witchcraft. The superstitious in some parts still believe that any small part of this tree, carried about them, will prove a sovereign charm against all the dire effects of enchantments and witchcraft, and their cattle also, as well as themselves, are supposed to be preserved by it from evil. Gilpin mentions in his "Forest Scenery," that often in his time a stump of the mountain ash was found in some old burying-place, or near the circle of a Druids' temple, the rites of which were formerly performed under its shade; and Evelyn mentions the custom of planting this tree in Welsh churchyards as a preservative against fascination and evil spirits. When in "Macbeth," the witch requests chestnuts from the sailor's wife, her exclamation should be, as no doubt Shakespeare wrote it, "A rowan tree, witch!" and not "Aroint thee, witch!" which is a corruption, and the former reading has been given by many commentators.

The quince was considered by the ancients to be the emblem of love, happiness, and fruitfulness; it was dedicated to Venus, and the temples of that goddess at Cyprus and Paphos were decorated with it. The nuptial chambers of the Greeks and Romans were decorated with the fruit; and the bride and bridegroom also ate of it as soon as the marriage ceremony was performed. It also has been supposed to be the golden fruit of the Hesperides; and a statue of Hercules discovered at Rome, with a quince in one of the hands, has been referred to as a proof. The Farnese Hercules has, however, apples in hand. It has also been alleged that the golden fruit thrown by Hipponenes to Atalanta, and the fruit of the forbidden tree, which the Jewish traditions expressly describe as golden, were quinces.

The walnut tree was dedicated to Diana, and the festivals of that goddess were held beneath its shade, and the Greeks and Romans strewed walnuts at their weddings. Collinson, in his "History of Somersetshire," speaking of the Glastonbury thorn, mentions that there also grew in the abbey churchyard, on the north side of St. Joseph's Chapel, a miraculous walnut tree, which never budded forth before the feast of St. Barnabas, and on that very day shot forth its leaves and flourished like other trees of the same species. He adds that this tree was much sought after by the credulous; and that Queen Anne, and many of the nobility of the realm, even when the times of monkish superstition had ceased, gave large sums of money for small cuttings from the original.

The Scythians used the willow for divining rods, and the Druids are said to have made huge figures of basketwork of it, which on great occasions were filled with criminals and set fire to; but some contend that these baskets were formed of the twigs of the oak. The legendary origin of the weeping willow, according to the Arabian story tellers, is as follows:—"They say that after David had married Bath-sheba he was one day playing on his harp, when he found two strangers opposite to him, though he had given strict orders that no one should invade his privacy. These strangers were angels, who made him convict himself of his crime, nearly in the same manner as it is related in Holy Writ. Forthwith he threw himself upon the floor and shed tears of bitter repentance. The tears from his eyes formed two streams, which ran from the closet into the ante-room, and thence into the garden. Where they sank into the ground there sprang up two trees, the weeping willow and the frankincense tree; the first weeps and mourns, and the second is incessantly shedding big tears in memory of the sincere repentance of David." The branches of one of the weeping willows on the banks of the Euphrates are said to have caught the crown from the head of Alexander the Great, when he passed under the tree in a boat on that river, a circumstance which made the Babylonish diviners predict his early death. W. R.



ENGLAND.

As the season has hitherto been so highly favourable to planting operations this department of forest work will now have made great progress. When the trees are of tolerably strong growth, and have already stood in exposed situations, but little risk will attend the continuance of the work in favourable weather. On the other hand, the removal of trees from sheltered nurseries to bleak and exposed quarters will now be attended with great danger. Beware of planting in frozen soil, and keep trees out of the ground as short a time as possible.

The cutting and clearing of coppice wood will now be far advanced, and no time should be lost in carrying away the produce as soon as frost sets in.

Continue the deepening and scouring out of old ditches, and lay out new ones where required. Upon very wet soils, where good open ditches are few and far between, the observant woodcutter can tell of much larger growths of underwood from the stools that stand near those ditches.

At the risk of repetition, we would again insist upon the necessity of paying great attention to the drainage of woodlands. Proportion the distance between such drains, as well as their depth, to the requirements of the soil and situation. On fairly open land, 3 feet deep and 60 feet apart may suffice; on medium soil 3½ feet deep and from 40 to 45 feet apart; and on very stiff and retentive clays or peats 4 feet deep by 30 feet apart.

Give the bottom of every ditch sufficient width to work a spade easily along it, for future clearance. Except in rare cases, open ditches are alone adapted to plantation drainage. When the fall of the ground is considerable, cut the trench obliquely to the direction of the slope to intercept the surface-water, giving it sufficient fall to carry off the water without washing away the bed of the channel. Let all secondary drains discharge into the main in the in the direction of the flow, and never at right angles.

Where open ditches would cause great inconvenience cut a

narrow trench somewhat deeper than the ordinary drain, and lay in the bottom a thickness of several inches of broken stone. Place the draining-pipe upon the bed of stones, and well puddle its sides and top. The water finding its way into the stones, will rise up and be carried off through the pipes without the risk of the roots following it. Ordinary drains laid upon the bed of soil itself would soon be filled up with roots.

The benefits of good drainage are most observable in plantations of larch and sweet chestnut, and also in a less degree in those of ash and birch. Larch will grow rapidly in land moderately deep and porous. Upon very stiff and wet land it does not root sufficiently deep to prevent the young trees blowing up when exposed. Sweet chestnut will also make rapid progress upon dry, sandy, or gravelly land with moderate shelter, and it attains large dimensions on a deep and dry sandy loam; upon wet and cold-bottomed land it does not mature its wood; consequently the young shoots are very liable to injury from frosts. Its rapid growth, and the durability even of its sapwood in hop-poles, makes this a valuable coppice wood. Use plants of chestnut which have been two years transplanted in the nursery rows. When the seeds are put into the nursery cover them with 3 or 3½ inches of good soil.

Observe that though ash will grow and even flourish on moderately wet land, yet the toughest, and consequently the most valuable wood is grown on land not over-fertile, but light and moist.

Plant birch on light stony or sandy land, even where the quality is inferior. It flourishes over a wider range of soils than most trees.

Really healthy vegetation cannot exist where water stagnates, as plant food becomes too much diluted, and owing to the increased evaporation the temperature of the plant is always low, so that all chemical changes are retarded. Even where there is heat as well as moisture, if air cannot reach the roots, the produce is leaves alone, and not fruit. Deep drainage supplies the roots with air, as air always follows descending water, whereas surface evaporation checks the descent of air. Where the sun's heat is exhausted in evaporating water, it cannot warm the soil.

The drainage of peaty and clay soils is especially desirable, as when well filled with moisture and afterwards dried by the sun these soils lose about twenty per cent. of their former bulk. By this means the roots of trees embedded in them become so compressed that air is entirely excluded.

Push on the falling of all hardwoods except oak. It may be necessary to look over and again daub young transplants, as rabbits generally pay greater attention to these than to the seedlings which spring up in the wood.

Where sufficient leaves have not been collected, there is still an opportunity of getting them from ditches and hollows into which they have drifted.

Fencing and road-making may still be continued. Suit the work to the weather, and thus economize both horse and manual labour.

Take advantage of frosts to cart composts to the nursery, and turn and well mix all lumps of lime and soil intended for spring use.

Watch the fallage of underwood, and see that the stools are well trimmed down. Select the best tillers, and see that they are evenly distributed over the fall. Put brush on clearance roads before cartage commences. Also look well to wire netting and other fences round nurseries.

The carting of building materials and of limestone for burning may now go on. Seasoned timber also may be prepared for use in exposed situations by creosoting, kyanizing, soaking in hydrate of lime, or in a brine of salt and water.

Green timber may be rapidly seasoned by covering it up for a few weeks in repeated layers of hot lime. In the same manner a deep and rich mahogany colour may be imparted to elm planks by burying it for a time in heating stable manure.

A. J. Burrows.

Pluckley, Kent.

SCOTLAND.

Owing to the wet, unsettled weather which prevailed during the earlier part of last month forest operations have been very much hindered. The roads and drives throughout plantations being quite soaked with water, traffic thereon has been rendered almost impossible. Towards the end of the month, however, a hard frost set in, which soon converted the softest drive into a hard serviceable road capable of resisting the heaviest traffic, advantage of which no doubt has been taken to get as much timber as possible carted off to wherever its destination might be.

However anxious foresters may be to prosecute the felling of timber, it is very likely that for the greater part of this month at least many of them will have to make way for the sportsman. The shooting of game coverts will now be pretty general, and as a consequence the plantations must be left undisturbed. No forester will have any difficulty in finding employment for his men at other necessary work where they will not disturb any game.

All dead or broken trees can be grubbed out of the lawn, the park or the pleasure-grounds, and the brush burned on the bare soil, before

it is levelled in, while the limbs can be cross-cut, and made ready for carting off some frosty morning when the ground is hard. Hares and rabbits have commenced to nibble the bark of conifers, hollies, laburnums, &c., and where such is the case, the greatest vigilance and promptitude is necessary in dealing with them, as it is quite a common thing for a valuable tree to be ruined by those brutes in the course of a single night.

The drives and rides in plantations should also be gone carefully over, and wherever rabbits are found burrowing under them, the holes should be followed up with the spade to their farthest extremity, any wretches found in, being mauled of course. Hunters and shooting ponies are sure to be galloping along the drives, and the footing over these rabbit holes is often of the most frail and treacherous description, and should be looked to and remedied at once.

Holly berries are a very plentiful crop this year, many parts of the plantations during the past two months having had quite a gay appearance with their ruddy glow. Foresters who have home nurseries in charge should take the opportunity of laying in a good stock of these. The holly is a slow grower in the nursery, and it is well to keep up a good succession of these hardy and most useful plants. I would also remind foresters that these berries require to lie a year in sand before being put in the seed bed.

Continue the sawing up of wood for joinery and fencing purposes. In the event of snow putting a stop to outdoor work the men can be employed charring and tarring paling stobs and gate-posts under cover, making gates and hurdles, repairing tools, and other work which can now be got forward against a busier time out of doors.

Dalkeith Park. ROBERT BAXTER, *Forester.*

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IRELAND.

The excessive rain of November and December very much retarded planting operations, and the work, where on a large scale, is considerably behind. Still with a new year most foresters are sanguine of better weather, when much that is at present behind will be overtaken. The rainfall during the year just closed has been in this country quite unprecedented, and "'77" will long be remembered as the "wet year." Many of our plantations have made excellent growth last year, particularly some young groves of larch and Austrian pines; but in the nursery seedling larches are very deficient.

Planting should now be carried on with despatch. All deciduous

trees ought to be lifted and laid or sheughed in ready for removal. Evergreens ought to be laid very thin in the "sheugh" to prevent heating, as they are apt to do when laid in thickly. We prefer this month for refilling young plantations and replacing all failures. This should be done early in the month.

Quick hedges should now be planted on previously prepared ground. Line fences should also be planted on ditches (*pro.* for turf fence). All deciduous hedges ought to be switched and plashed without delay. Trimmings of evergreen from the pleasure-ground may be drawn out to the wood, and laid into heaps for game coverts. Undercover may be extended by layering, and the present month will be found highly suitable for such work where large quantities of pheasants are preserved. Whatever planting and pruning are required in preserved covers should now be done while the game are hand-fed.

It is seldom thinning is timeously done in this country, and when it *must* be, it is too often overdone. We cannot, therefore, impress too strongly on foresters having charge of young plantations to see after all overcrowded woods, and have them judiciously regulated.

Draining, like thinning, is seldom executed until the damage is done. This and fencing will occupy the men to advantage during frosty weather when not too severe. Quarry and break stones for repairing the roads. Keep all the water-tables clear, and never allow an accumulation of drift to lodge near the mouth of the conduit.

Keep on planting in the nursery during fine weather. In laying out seedlings into rows, give ample room to each plant. We allow 15 in. between the rows and 6 in. between the plants, for larch and pine. Hardwood, 18 in. between the rows, and 12 in. between the plants. This gives fine stubby plants, and admits of thorough cleaning during the season.

Alterations in the pleasure-grounds ought to be wound up about the end of the month, and the walks and drives gravelled.

Ballinacourte, Tipperary. D. Sym Scott.

WALES.

Foresters who have a moderate extent of planting, thinning, and falling of timber, will be principally occupied much the same as last month. The first month of the year, however, is not generally considered one of the best for planting young trees; but where much planting has to be done in one season, there is sometimes little choice, as to time, providing the weather is open and favourable. So far we have not had frost enough to stop planting even for a couple of

hours in the morning. Such, however, may not be the case during the present month; and those who have much planting in hand should prosecute the work on the driest and warmest parts of the ground during all favourable weather.

Continue the cutting of underwood and thinning of plantations, as last month; and dispose of the produce as early as practicable, so as to have the plantations cleared out and finished up. By so doing the whole work may be carried on in proper rotation, and the timber removed before the sap begins to rise in the standing trees; after which time they are more liable to be damaged, and the bark more likely to be knocked off by dragging the trees. When the trees are sold by measurement, it is easiest performed before they are removed from the plantation, as after they are put into lots, one above another, they are difficult to get at.

Hedgerow timber should, if possible, be all cut down and removed during the present month. This class of timber is often valued and sold standing, at so much per lot, to be cut down by the purchaser; in which case he is bound to repair and make good all damage to fences, &c. Hedgerow timber is also sold at so much per foot, to be cut down by the proprietor, or purchaser, and afterwards measured in the usual way.

Repair roads and drives, and broken stones should now be put on with all possible speed where they are intended to bind. When stones are put on later than this month, they are apt to roll about and get the sharp edge off, and therefore do not bind and solidify together, as when put on earlier.

Trench vacant ground in nursery as last month. In removing large plants it will be necessary to go to considerable depth to get to the bottom of the roots, when the soil will be well loosened and turned up.

In collecting and carting leaves it is best to take advantage of dry and calm weather.

LEWIS BAYNE.

Kinmel Park.

[*Correspondents sending letters signed with initials or fictitious names are requested to enclose their name and address, as otherwise their communications cannot be inserted.*]

THE SILVER AND DOUGLAS FIRS.

Sir,—No one admires the silver fir more than the writer, but beyond its majestic appearance adorning the side of an avenue, I fail to see its merits as a forest tree. Mr. McCorquodale, of Scone, passes a high encomium on this tree when he says, "As gate and common wire fence-posts I consider silver fir the most durable of all our commonly grown firs, larch excepted." If we visit the north of Scotland and inspect some of the old houses and fences in Rannoch, Badenoch, and Strathspey, we shall see what has often been advocated, that *matured native pine*, Scots fir, is the most durable of all our firs, because in Strathspey there are fences erected with bog deal which have stood for the last 40 years, and were nothing the worse for the wear four years ago. As to Abercairney and Braco estates being at one period famous for their silver firs, I may say that the trees are still standing, and are magnificent specimens, and highly ornamental. Mr. McKenzie, forester, Murthly, predicts, with considerable confidence, "that *Abies Douglasii* will sooner or later take the place of our larch." Now, living as we do in an age of inquiry, no forester is worthy of the name, unless endowed with an insatiable desire to acquire knowledge; therefore the writer, in common with many others, will be glad to see this subject discussed on the principle of pounds, shillings, and pence. Facts and figures are often widely divergent. The latter are easily committed to paper, but the former must be realized. This is necessary, because the value of an article is not what it is worth but what it will bring or realize when produced and offered for sale. In 1870 I conducted a sale of timber in Strath-Oykle, Sutherlandshire, one lot of which was a field of seven mperial acres. The trees were classed as follows:—Scotch fir timber 615, spars 1,795, props 520, larch timber 1,385, spars 2,400, props 340, spruce and other trees 305, total 7,360. The plantation was 45 years of age, seven miles from a railway station, but close to a good road. The lot realized, for the time it occupied the ground, £4 per annum, per acre. The highest rent for arable land in the same Strath at the time (it has been realised since) was only 14s. per acre. I will state another case on

the estate of Cappanniacke, distant five Irish miles (nearly eight British) from a railway station. I have just sold from off 22 Irish acres (over 34 acres imperial) 2,241 tons weight of larch, 31 years old at 15s. per ton. The highest rent for arable land in the neighbourhood is only 7s. 6d. per Irish acre. Taking these figures into consideration, the question will suggest itself, Will the same area of ground produce the same quantity of either silver fir or Douglasii, and will they in the same time realize the same price? In this country larch should never occupy the ground longer than from 30 to 4 years, unless under very favourable circumstances. By a regular course of rotation in cropping, no tree will compare with larch, nor realize within a moiety of its value. I strongly recommend that in all new plantations the great preponderance be larch, and in a majority of cases exclusively larch. Being deciduous, the ground in winter receives its due quota of moisture, which in a measure restores fertility and admits of a greater number of trees being accommodated on the acre. To show my appreciation of larch, I may state that I am planting upward of 400 acres this season, and four-fifths of the plants are larch.

Ballinacourte, Tipperary. D. Sym Scott.

IRON PRONGS FOR FENCING.

Sir,—From an extensive experience in the erection and keeping in repair of various kinds of wooden, wire, and continuous bar fencing, I must say Mr. Baxter's iron prong is the most temporary support (intended to serve for ten years) I have ever seen adopted, seeing, as must be apparent to all, that the prong is only of a weak construction, being a single prong, and if used as shown in Messrs. Main and Co.'s sketch, has no staying power whatever.

The expense of this fence is greater than a good iron and wire one, if the stobs are worth sevenpence each, placed at three feet apart, and the price of five paling rails, and cost of erection are added, together with the prongs, even although the latter are reckoned to last for 100 years. For we must also, when reckoning the value of the iron and wire fence, expect the standards to last as long as the prongs would do. Even though a penny per yard is saved by adopting wood for fences instead of the iron and wire, in the course of fifteen years after erection the iron and wire would be the cheaper fence of the two by far.

However, had the double prong been adopted, we should have an article of some service.

Wooden fences are a thing of the past, and inferior beech and spruce could be sold to greater advantage than used for fencing purposes, while iron and wire, or continuous bar fencing, would be by far the cheapest in the end—either of which every proprietor of land should erect when the fence is to be a permanent one. I have seen an excellent iron and wire fence erected for 1s. 7d. per yard, where the cartage was performed by the proprietor; and a very substantial continuous bar fence for 2s. 11d. per yard, and from

Mr. Baxter's description of his fence I would not fancy it costs less than 1s. 5d. per yard, independent of the prong supports, consequently we have yet to find out an article or method cheaper than this prong ere our search or study can end.

THOMAS WILKIE, *Forester.*

Ardkinglas, Inverary, Dec. 12, 1877.

[We would recommend our correspondent to look again at the figure on page 585, where he will plainly see a "double prong," the same as used and recommended by Mr. Baxter. We have recently had practical proof of the stability of a fence supported by these prongs for the last three years, during which its "staying power" has been sufficient to resist the force of storms, the attack of horses, heavy cattle, Highland bullocks, and lesser animals, and at the present day stands a substantial, secure, and firm fence. A fair trial is the only proof required to test their efficiency, and it is unnecessary to discuss the question farther without practical experience of the matter.—ED.]

HAND-BILLS.

SIR,—As the kind of axe most suitable for felling the different descriptions of timber is now undergoing discussion in the pages of the journal, would it be out of place to offer a few remarks respecting the *bill*, the illustration of which is given in page 392, and is there stated to be the only one capable of doing forest work efficiently and thoroughly. I must confess that I never saw one used that would be at all like the illustration. I fancy if the woodward was cutting down a thicket of underwood with such a bill, he would not be long before he lamed himself or some one else, on account of the turned-up nib at back of the bill; and I do not think such a bill would be suitable for bark-peelers; the projection at the back would be more in the way than anything else. Again, the bill would be useful for dressing the kind of underwood suitable for crate rods and thatchwood, after doing away with the projection and rounding the point, making it in appearance to resemble the blade of one of Saynor's well-known large pruning-knives. Presuming it should prove to be sufficiently light, as a heavy bill would not be suitable for this kind of work, the most suitable hook, or bill, used for cutting down underwood, and for general forest work, such as lopping off the small branches from felled timber, cutting small cordwood, &c., should, in my opinion, answer to the following description:—Length of cutting-blade, 13 inches; width, about $2\frac{1}{2}$ inches by the handle, to $3\frac{1}{2}$ inches at widest part; thickness at back, $\frac{3}{8}$ inch. The hook should be made straight at the cutting edge and back, to near the extremity of the blade. The point should then be made *parrot-nosed;* this is the best expression I can find, so that everybody may understand it, as most of the hooks obtained from nurserymen and

ironmongers are too much rounded on the back and front edges for general forest work. The rounding at the point should extend below the straight edge ¾ of an inch, and up the blade about 2 inches. The handle of the hook should be shaped as in the illustration, with the exception of the socket. I should prefer a *ferrule* on the handle, and a *shank* to the hook, to go through the handle, and to be well riveted on. Presuming you will not think these remarks out of place, as my sole object is to add my mite to enable us to advance towards perfection, and also to induce a free discussion on subjects connected with the profession.

Hawkstone, Salop. RICHARD JANDRELL.

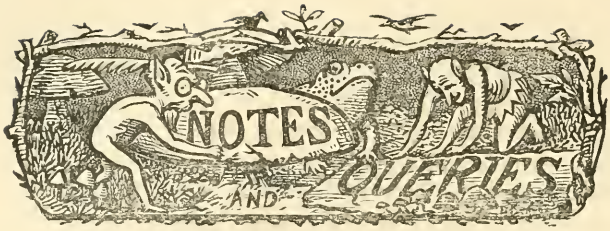
THE SILVER FIR.

SIR,—In last issue I observe an article of considerable importance on the use of "Silver Fir for Railway Sleepers, &c." I have often been disappointed with the price realized for silver fir, as I consider it more valuable than Scots fir for any purpose where it is exposed to the atmosphere. As a proof of this I will give an example which came under my notice.

Many years ago a shed was put up in which to dry wood. The roof was constructed of three-fourths silver fir boarding, but to complete the same *one* Scots fir board was used, which was sawn from a tree of the same age, and which grew in the same place as the silver fir. After a few years the Scots fir board was found to be decayed, and replaced by another of the same kind; and lately, when the shed was removed, this second Scots fir board was by far the most decayed of any in the roof. This roof had never been tarred nor covered in any way. When silver fir is clean grown it makes very durable paling, but is perhaps more easily broken than common fir.

Another recommendation to the silver fir is the rapidity with which it grows, especially where the soil is of a suitable nature, and it is to be found doing well on a variety of soils. Last spring I saw a silver fir cut which measured 60 feet. In the same plantation, none of the other varieties measure above 40 feet, and only few that much, while the larch are much affected with dry-rot. The experiment begun by such an experienced observer as Mr. McCorquodale will be, I have little doubt, of great commercial importance, not only to growers of wood, but also to the railway companies, and I hope to see the sleeper thus tried reported on annually in your journal.

M. R.



[*The Editor requests the assistance of Readers in answering Queries, so that the usefulness of this Department may be maintained.*]

Oak-galls.—The oak-gall fly (*Cynips querci*) is herbivorous, and belongs to the order *Hymenoptera*. The female is armed with a sting or ovipositor, with which she makes a puncture in a leaf or twig, and at the same time deposits an egg therein, around which the well-known excrescence, the oak-gall, is formed, furnishing a nidus for the grub or larva when hatched. When the insect arrives at the matured state it eats its way out of the gall, and escapes a full-grown fly.—D. S. S.

Barking Irons are extremely simple to make, and any forester of ordinary aptitude, with the assistance of a common country smith, can make his own. Get a bar of iron $1\frac{1}{2}$ in. × $\frac{1}{4}$ in. ; cut it into 14 in. length, turn 4 in. at one end for a socket for handle, and slightly curve in the blade. Sharpen the edge, but it requires no steel. A common mortising-chisel slightly curved will serve as a perfect model.—D. S. S.

[The query of "D. M." is (see page 589)—Where can barking irons be got *ready made?*—Ed.]

Books.—Can you recommend a *complete* and *cheap* work in English on the art of forestry and the duties of a forester?—A Young Forester, *anxious to learn.*

[We wish we could! Read the Journal regularly, and save up your spare cash till you can buy Brown's "*Forester*," Blackwood and Sons, Edinburgh. Nothing better or cheaper in English.—Ed.]

Privet.—I have a plantation which has got so completely overrun with privet as to be perfectly impenetrable to men, or even dogs; so that it is a downright nuisance, and a great hindrance to the enjoyment of a day's shooting. Can any of your readers tell of an expeditious and not too expensive way to get rid of the privet?—W. C. L. C., *Naseby Hall, Lincolnshire.*

Cover for Wild Ducks.—Being required to plant a low flat island of about $1\frac{1}{2}$ acres and the shores of a pool or lake about 20 acres in extent with cover for wild ducks breeding in, what would you advise me to plant? The situation is rather exposed, and the soil thin and poor. None but the hardiest plants, I am afraid, will exist. A reply from you or some of your correspondents will greatly oblige—G. P., *Wicklow.*

Black Game Injuring Trees.—I have charge of a large young plantation of larch and Scots fir, which is very much injured each season by black game. As I cannot get permission to shoot or kill them, can you or any of your readers tell me of any other *sure* and *practicable* method of preventing them injuring the trees ?—J. M., *Galloway.*

Planting Irons.—Where can I purchase, in the south of England, the *planting iron*, or small planting spade, so much used for planting trees in the north of Scotland ?—Robert Mackay, *The Moor Manor, Dorset.*

Squirrel Traps.—Can any of your readers inform me of the best trap to catch those lively little animals, giving the best position in which to place it, and the best bait to use ? Or can any one describe a plan they have found effective in driving them away (not killing them) from a plantation ?—R. Taylor, *Dumbartonshire.*

Planting Peat Bog.—Having a few acres of flat-lying, deep peat bog which I am desirous to grow trees upon, for ornament and shelter as well as for use, but which can only be well drained to a depth of about 4 feet from the surface, I would feel greatly obliged if some of your able correspondents would kindly advise me what to plant with a fair prospect of rearing good-sized trees. I have tried larch and Scotch fir, but both soon rot at the heart. Can any one suggest a remedy for this ? Want of an outfall will not permit deeper draining.—*Munster.*

Mistletoe on Fir.—This is said to grow on the "fir" [Scots pine ?] in Germany. Do any of your numerous readers know of a plant of mistletoe growing on a fir or Scots fir in the United Kingdom ? Or do any of them know of it growing on any *coniferous* or *resinous* tree in this country ? If so, would they kindly favour us by naming the species of *conifer* the mistletoe is growing upon, and where it is to be seen in Great Britain or Ireland ?—L. B. White, *Chelsea.*

Tree Roots Choking Drains.—I am put to much annoyance and expense by the roots of beech and lime trees continually choking some stone and tile-pipe drains which run through a plantation and are necessary for its drainage, and that of a park lying above it. Can any of your correspondents, who have had practical experience in the matter, inform me of a plan to prevent the roots choking the drains, and yet allow of the free ingress of the water to the pipes ?—Inquirer.

Water Supply of South Africa, and Facilities for the Storage of it. By John Croumbie Brown, LL.D., &c. Edinburgh: Oliver and Boyd.

In a well got-up and closely printed octavo volume of over 650 pages, Dr J. C. Brown has brought together, by careful and assiduous compilation from almost all available sources, an immense amount of valuable information upon the evils attending the want of a proper knowledge of the laws of nature, and the devastation worked in many countries by an ignorant or wilful disregard of them. Considering the small amount of philosophical inquiry which has been devoted to the all-important subject of water supply and storage in most parts of the civilized world, we have perused Dr. Brown's most elaborate and exhaustive book with much interest and satisfaction. The author enters very fully into the literature of the subject, and draws deductions from detailed meteorological observations made in all parts of the world, which, with his own observations and experience, he applies in the most apt and convincing manner to the solution of the important question for which the book has been specially written, and justly ascribes the cause of the aridity of Cape Colony and the other South African states to the wasteful destruction of trees and herbage, forcibly contrasting the reckless indifference of the colonists to the consequences of such wanton neglect of their forests, by comparing it with the wonderful skill and energy displayed by the Chinese hydraulic engineers, from a very remote era to the present time, in successfully combating even a worse state of things in the Flowery Land.

In the first part of the work the author enters fully into the philosophic details of the humidity of the air and rainfall, and the conditions by which they are influenced; the theory of clouds, and their amount and peculiarities at the Cape, with descriptions of the formation of the various kinds of clouds, and the amount of moisture they represent; the theory of winds and thunderstorms, and their relation to the rainfall; with tabulated abstracts of numerous meteorological observations made at the Cape and in various parts of the world, and a description of the best instruments used in making these observations. Part II. describes in an exhaustive manner all the sources from which are derived the present supply of water, available for agricultural and other purposes at the Cape and in the adjacent regions; with suggestions as to how it can be increased by the conservation and extension of forests, and more profitably utilized for man and irrigation by storage. Part III. takes a minute survey of the general

supply of water, and the facilities for its storage in the colony of the Cape of Good Hope; and Part IV. is devoted to a general review of the water supply in the adjacent colonies, and the facilities they possess for its storage and distribution.

Dr. Brown has thus taken such a comprehensive view of all the details of the subject, that his book forms a complete encyclopædia of practical meteorology and hydraulic engineering, which may be studied with great advantage to any country suffering from such serious calamities as arise from an arid climate, with insufficient storage for water, and defective irrigation works, or which is subject to the destructive inroads of sudden and violent floods. The terrible famine now working such havoc amongst the natives of India, and the dreadful floods which devastated the south of France a few years ago, are the result of neglecting important natural laws, which the author very clearly explains, and supports his explanations with an abundance of corroborative evidence collected by indefatigable industry and with great care and discrimination, from a numerous array of trustworthy authorities. The full and varied information which this book contains upon the subject of water supply and its storage, will make it a source of much interest and profitable reading to all who take an interest in our Cape and Australian colonies and India, where the want of a regular and sufficient supply is so severely felt.

The Timber Trades Journal. Fortnightly. Price 4d. Published by J. and W. Rider, London.

Amongst our numerous contemporaries which devote their attention to some special branch of industry, the *Timber Trades Journal* holds a leading position, as being the sole exponent in Britain of our home and foreign timber trade, and is so closely connected with one branch of a forester's duties, the profitable disposal of our home-grown timber, that we consider its merits fully entitle it to be brought before the notice of our readers. Besides interesting and instructive original articles on the timber supply of the forests throughout the various countries from which we import that commodity, and the state of trade in connection therewith, it gives excellent descriptions, illustrated by neatly got-up and clearly executed plans, of the docks and harbours in the United Kingdom, which are chiefly frequented by timber trading vessels, and instructive and popular information upon a numerous variety of subjects of much interest to those engaged in the importation, and buying and selling of timber. Periodical details are given of the Board of Trade returns, so far as they concern the importation of wood, and special details are given of the amount of timber in stock at the various ports in the United Kingdom, and the amount and quality of all the imports of timber and wood goods at the different ports during the previous fortnight.

Valuable notes are also given upon all the leading timber sales, with full particulars of the quantity, quality, and prices realized for every description of imported timber. Forthcoming sales of foreign and British timber

are announced, and occasionally details are given of the prices realized at sales of the latter, and we trust that this department may be farther developed until it gives the results of all the leading sales of home-grown timber in Britain.

The *Journal*, which is now in the fifth year of its existence, has by excellent management, and the expeditious supply of correct information upon all matters connected with the timber trade, quite gained the confidence of the public, and is widely read, both at home and abroad, amongst all those who are in any way interested in the sale of timber and its manufacture. To those of our readers who have timber to dispose of, it offers a most valuable medium for bringing their goods directly under the notice of the principal buyers in the United Kingdom, while a perusal of its contents will afford much instruction and matter for study as to where the best market can be found for their ready disposal ; to such and all others interested in the timber trade we can confidently recommend this Journal.

Influence of Temperature on the Germination of Pine Seeds.—Some experiments were recently made by M. Velten, of the Vienna Academy, with a view to determine the influence of a previous warming on the development of pine seeds. The latter were kept in darkness and sown in shallow glass vessels, the bottoms of which were covered with wide-meshed nets. The seeds were heated four hours to 40°, 45°, 50°, 55°, . . . 100° C., and then left to germinate. Seeds gathered in 1872 in a locality in which the fir thrives well first showed that the greatest number capable of germination occurs in the case of unheated seeds—that, with raising the temperature the germinating power gradually diminishes, and that through one hour's heating to 80° C., the *nil* point of germinating capacity is almost reached. The heated seeds nearly always germinated more slowly than the unheated ; but a quarter of an hour's heating had hardly any influence. The germinating force also showed a decrease with rise of temperature, and gradually approached the zero point. In a second series of experiments seeds of pine comes collected in another region, in the autumn of 1875, showed that a heating to 40° had hardly an influence on the germinating power. On raising the temperature to 70°, however, the germinating number was observed repeatedly to rise, but without reaching that of the unheated seeds. The germinating force, on the other hand, presented, as in the former case, a gradual decrease, with raising of the temperature. Further experiments were made, in which the previous heating of the seeds was continued longer, the lower the temperature; and, lastly, experiments were also made with like seeds at different times after they had been gathered. The following deductions were arrived at:—(1) The germinating per centage, as well as the velocity of germination, gives no certain indication as to the germinating force of the seeds ; and the converse also holds good. (2) The heating of the seeds may have a favourable or an unfavourable influence on the germinating capacity and the germinating force, according to the physiological condition in which the seed is. (3) The duration of heating of the seed is of essential influence on its development, inasmuch as long heating at lower temperatures can produce the same effect as short heating at higher temperatures.—*Garden.*

Conifers in Cornwall.

THERE are some fine specimens of various kinds of conifers growing at Lamoran, the seat of the Hon. and Rev. J. T. Boscawen, upon which the *Journal of Horticulture* recently had the following remarks :—

Amongst the most conspicuous trees are a number of magnificent examples of *Pinus insignis*. This tree as seen here is certainly worthy of its title of "the remarkable pine." All are in perfect health, and some are wonderfully vigorous, being eighty feet high, with huge rugged stems feathered with branches to the ground, clothed with foliage of that bright rich green tint which makes this tree so striking, and for which it is so much valued. It makes a splendid tree, and judging from what subsequently came under my notice during my tour in Cornwall we have no hesitation in saying that it is quite the best pine for that county. It bears exposure perfectly, it becomes established quickly, grows with singular rapidity, and its timber is really valuable, some boards of it which Mr. Boscawen had nailed upon the gable of a building twelve years ago, and there left fully exposed without any covering of paint, being still perfectly sound and free from any traces of decay.

Several other conifers must have notice, and first most worthily comes a noble specimen of *Sequoia sempervirens*, the Californian redwood tree, to which a very picturesque effect has been imparted by cutting off the lower branches so as to show the curious bright red spongy bark, so soft as to yield to the slightest touch. *Picea Cephalonica* is well represented by some excellent specimens ; it is one of our best conifers, superior to *P. pinsapo*, but unfortunately not quite so hardy in many situations. *Cupressus Lambertiana*, *Thuja Lobbi*, the rough-barked Mexican pine, *Pinus Montezeumæ*, *Pinus maritima*, and *Cedrus Atlantica* are all growing in fine specimens here, *Cedrus Atlantica* being especially remarkable for its strong free growth and perfect health, offering a striking contrast to the stunted sickly appearance of the deodar, which is evidently not happy here. We were glad to see *Picea Webbiana* in excellent condition, and evidently full of growth, but it is questionable whether it will attain to a very large size, as it is already producing cones. Among other rare conifers is a beautiful specimen of *Fitzroya Patagonica*, ten feet high, a perfect gem, with graceful pendulous growth, forming an object of great beauty ; and, wonderful to tell, there is actually a flourishing specimen of *Dacrydium Franklini* here, surpassing all other weeping trees in the elegance of its long, graceful, pendent branches. It is curious to see how quickly even the leading branches conform to the general character of the whole tree, for after a very brief growth upwards down they go, falling over each other in no regular order, but with an easy, careless air, full of grace, to which the somewhat loose clothing of leafage adds another charm. The position

of this *Dacrydium* undoubtedly contributes something to its effect; and we may usefully note here how much more telling pendent-growing trees are when planted on slopes above a walk than when seen on a plateau or level lawn. They are, moreover, equally effective upon soft gentle slopes and steep rocky declivities; while, on the contrary, trees of such precise growth and rigid aspect as the *Araucaria* are not in keeping with soft lines and sweeping curves, but require scenery of bolder, wilder, sterner aspect.

FOREST POETRY.

THIS fragment is from the romance "The Epic of a Day," descriptive of a dream of Lilla trees by moonlight—the eve of battle.

"On yester eve, when sobs leaped from my heart,
And gushing tears were wrung from trembling brain,
I wildly gazed to catch some thought apart
From that keen grief that throbbed each pulse with pain.

Thine eyes glowed love, yet in them gleamed farewell;
As fleecy clouds sailed by, like spirits blest,
Behind the forest screen in which they dwell—
Its leafage fed with fancy, my unrest.

The moon, so mocking calm, flung clouds aside;
Traced outline shadows to my feverish view
Amidst the trees, where now it paused to hide,
Anon to shine and pierce the foliage through.

The leaves and branches took fantastic forms,
As if engraven on moon's silver disc;
The oaks portrayed an ocean tossed by storms
On rocky shores. But thou wert safe from risk.

The drooping pines next interposed their screen,
Like banners waving o'er the battle fray;
My gaze sought for thee in this awful scene,
And hailed the laurelled victor of the day.

Like giant guard the blighted cedar stood;
The ash, with slender arms and open fingers,
Bright garlands waved. The moon, with life imbued,
Behind the birch's lace-like foliage lingers.

And there, amid its tracery of leaves,
That seemed as 'twere my very bridal veil,
I stood beside thee, decked with orange wreaths,
And joys of life o'er scenes of war prevail.

My life thus blended all within thine own
Gave every joyous hope a double charm;
—While thus I dreamed, the night to morn had flown,
Before I knew I'd slumbered on thine arm."

Bobbington Manor Farm Estate.—This property, consisting of about 287 acres, in the parish of Bobbington, Staffordshire, was disposed of by auction by Messrs. Sollom and Barnett, at the Star and Garter Hotel, Wolverhampton, on the 11th ult., in eight lots. The principal portion was purchased for the Earl of Dudley for £12,820, including the timber; and another small lot was bought for Lord Wrottesley.

Sale of an Aberdeenshire Estate.—The estate of Grange, lying in the neighbourhood of Peterhead, has recently been purchased by James McCombie, Esq., from Alex. Walker, Esq., for the sum of £12,400. The property comprises 140 acres, mostly excellent arable land, a portion of which is laid out as market gardens; the rental of the whole estate being £408 per annum.

Escallonia Macrantha in Nottinghamshire.—This is one of the best evergreen shrubs which we have for planting against walls having a south or west aspect. It grows freely in loam mixed with a little sand. When in good health, the foliage is of a bright and cheerful tint of green; and now, when in flower, it is very effective. *E. Ingrami* is another good variety; both are quite hardy here, having stood unprotected for six years.—A. H., *Thoresby.*

Experiments with Tonite.—On Wednesday, 21st Nov., some interesting experiments with the new explosive, tonite, or cotton powder, were made by the Earl of Airlie, on his estate of Cortachy. The material does not contain the means for its own ignition, and is said to be as powerful as dynamite. Several tree roots were scattered successfully.

Juniperus Sabina.—The most perfect specimen of this shrub that has come under my notice is to be seen growing on the lawn at the rectory here. Its height is 5 ft., and its circumference 72 ft.—Richard Nisbet, *Aswarby Park, Folkingham.*

Durability of the Wood of a Coniferous Tree.—A remarkable instance of this is recorded by Mr. John Buchanan in the "Transactions of the New Zealand Institute." The tree in question is *Podocarpus spicata*, the "Mai," or "Kaka-terro" (big tree) of the Maoris, a common forest tree of enormous size and great height, found almost throughout the island of New Zealand. Mr. Buchanan describes a prostrate trunk, which was pointed out to him in a valley near Dunedin. He calculates that the tree must have lain where he saw it at least 300 years, from the fact that its trunk was enfolded by the roots of three large trees, which must have grown from seed since its fall. The three trees seated upon it and rooting in the earth on both sides, thus holding it in their embrace, are all *Griselinia littoralis*, with trunks 3 ft. 6 in. in diameter. They were recently felled, and the growth rings count over 300, thus approximating 300 years.

Willow Bark for Tanning.—The *Deutsche Gerber Zeitung* observes that the Berlin exhibits, German and foreign, of leather tanned with willow bark furnished conclusive proof of the value of the willow for tanning purposes. The Russian firm of Aliantschikoff, of Kamisov, was conspicuous in this respect, the excellence of their light feathers being equalled by the perfect tanning of the heaviest sole leather by willow-bark.

A Beautiful New Tree (Phellodendron amurense).—This, a native of Siberia and Mandschouria, is just now a beautiful object in my garden. My specimen of it is about 12 ft. in height, and has a tall pyramidal crown of from 3 ft. to 6 ft. The form of its foliage, which is deeply lobed, gives it a singular appearance, and the coloration of the leaves, which are bright red, is very fine. It is also all the more valuable on account of its keeping its foliage much longer than other deciduous trees, which hereabouts have shed their leaves a fortnight ago. It has a spongy bark, and is called the Siberian Cork Tree.—*Max Leichtlin, Baden Baden.*

Pinus Insignis, at Powerscourt, Co. Wicklow.—A plant of *Pinus insignis* planted here in 1860, being then about three to four feet high, was blown down last month, after having made the following remarkable growths in seventeen years from the time it was planted. It had attained the height of 41 ft., and measured 3 ft. 2 in. in circumference of stem at 1 foot from the ground. Some of the annual growths were 3 ft. 5 in. and 3 ft. 6 in. in length, and one was 3 ft. 7 in. Out of the great quantity of conifers planted here this stands out pre-eminent, with its bright rich green foliage, which renders it easily distinguishable at a distance. Though it has proved to be not quite hardy in some parts of England, it is more hardy than many people are aware of. I have seen it withstand the frost when the thermometer had been within a few degrees of zero. This tree is remarkable for the great weight of foliage which it carries, hence the necessity of planting it in a good deep soil to bring out its massive foliage in perfection. If planted in dry gravelly soil the tree assumes a rusty appearance, and it will soon be perceived that it requires more nourishment. In most cases *Pinus insignis* withstands the wind admirably and makes tree growths, and is well adapted for planting in proximity with the *Cedrus deodara.—C. Penford, in "Gardener's Chronicle."*

Hard to Beat.—A remarkable frog story is told by the *Toronto Globe.* A pine log was being sawed into lumber at a saw-mill in Acton. The outside slab and one board had cut off, and while the workmen were turning over the log they were surprised to see a large toad poke his head out of a hole in which he was embedded, and where he had barely escaped being cut up by the saw. As the log was the fourth or fifth from the butt of the tree, his position must have been at least fifty or sixty feet from the ground. The animal was quite flat, and nearly as large as a man's hand. He was perfectly blind, but when taken from his bed he made use of his limbs to crawl away. The tree was perfectly sound with the exception of a decayed spot of about a foot in length below the hollow place in which he was embedded. The *Globe* man may have the belt, the Bay City *Tribune* liar will have nothing more to say after reading this.—*Lumberman, U.S.A.*

The Huon Pine (Dacrydium Franklini) at Longleat.—This most graceful pine, a native of Tasmania, is very beautiful, growing in the open air at Longleat, where it is quite hardy and bears fruit. It has attained a height of 31 ft. The graceful twine-like branchlets are of a beautiful grass green.

Cupressus Macrocarpa Submerged.—In the autumn of 1875 I planted a *Cupressus macrocarpa* on a small eyot in the river Barrow. It was submerged that winter, and stood the ordeal well, appearing none the worse the following year. Last winter, though actually from 2 ft. to 3 ft. deep in water for two months continuously, it has, to this day, a beautiful rich green colour, and is growing fast. This tree seems to flourish well in almost all soils.—J. H. W. Thomas, *Belmont, Carlow.*

The Strawberry Tree (*Arbutus Unedo*) —Both large and small specimens of this handsome evergreen shrub are very effective at this season; viewed simply as an evergreen shrub, it is worthy of a place in even the most select collection, but when covered with large clusters of white pendent flowers intermixed with handsome strawberry-like fruit, it is especially attractive. It is not planted so largely as it deserves to be, for it will grow almost anywhere, and is especially adapted for seaside planting. Its contour is improved by just a little shortening back of the long shoots in March.—E. H.

Phellodendron Amurense—a very hardy ornamental tree, flowered last season at the Cambridge Botanic Garden. It has been there fifteen years, so it is quite hardy. The plant is diœcious, and a native of Mandschuria. It grows in its native habitat at 50 ft. high, and has a trunk 1 ft. thick, with a corky bark. It is allied to *Ptelea* and *Xanthoxylon.—Garden.*

New Public Park for Birmingham.—A new public park, extending to about 40 acres, valued at £30,000, has been presented to the city of Birmingham by Miss Ryland. It is situated at Small Heath, and is being laid out under the superintendence of Mr. Marnock, of London, the eminent landscape gardener.

Erratum.—In reference to a paragraph on ornamental maples which appeared at page 596 of our last issue, Mr. Berry asks us to make the following correction:—"Acer platanoides Lorbergi is a deeply cut leaved variety resembling A.P. dissectum, and not a purple-foliaged tree. A.P. Schwedleeri is the variety with bright reddish purple foliage when newly unfolded in spring, and its leaves are as large as the type, being also a vigorous grower. This maple will, I think, form quite an acquisition amongst pale green and yellow foliaged trees in spring, and exhibit a striking contrast.

Douglas Fir.—The Canadian steamship *Newfield* is on its way to France having on board two pieces of Douglas fir (*Abies Douglasii*), for the Paris Exhibition. The pieces are a transverse and a longitudinal section, taken from a tree over 400 feet in height and 8 feet diameter, found growing on the slopes in British Columbia.

Artificial Black Walnut.—The wood, first thoroughly dried and warmed, is coated once or twice with a liquid composed of one part (by weight) of extract of walnut peel, dissolved in six parts of soft water by heating it to boiling, and stirring. The wood thus treated is, when half dry, brushed with a solution of one part (by weight) of bichromate of potash in five parts of boiling water, and after drying thoroughly is rubbed and polished. The colour is thus said to be fixed in the wood to a depth of one or two lines, and in the case of red beech or alder, for instance, the walnut appearance is most perfect.—*English Mechanic.*

THE PENRHYN ESTATES.—Mr. Pennant Lloyd, High Sheriff of Flintshire, is about to give up the management of the Penrhyn Estates. He will be succeeded by the Hon. Sackville West, brother to Lord Delawarr. The Penrhyn tenants are going to present Mr. Lloyd, on his retirement, with a splendid Portrait of himself, executed by Mr. Sant, R.A. Major Plott, High Sheriff of Carnarvonshire, will preside at the presentation proceedings.

THE Moreton Bay Pine (*Araucaria Cunninghamii*) is, without exception, the most ornamental and useful tree in Queensland. Its beautiful regular pyramidal form, and the sombre green of its awl-shaped foliage, command general admiration. It covers immense tracts of land along the coast and in the interior. It often rises to a height of two hundred feet or more, and overtops all other trees, whether growing on the alluvial banks near rivers, or upon the steep and rugged mountains in the interior. Its branches are produced in whorls from six to eight, horizontally and spreading. The bark is thick and brownish. The timber is an article of great commercial importance, and is used extensively in the colony. The wood is strong and durable when kept dry, but soon decays when exposed to alternate damp and dry. When procured from the mountains in the interior, it is fine-grained, and is susceptible of a high polish, which excels that of satinwood or bird's-eye maple. The resin which exudes is very remarkable, as it has all the transparency and whiteness of crystal, and that portion of it which adheres to the trees hangs from them in the shape of icicles, which are sometimes three feet long, and six to twelve inches broad.

THE TREES IN SACKVILLE STREET, DUBLIN.—*Apropos* of the then expected visit of the distinguished statesman now sojourning in Ireland for the first time, and whose skill in wielding the felling axe is so well known, our pleasant contemporary *Zoz* was very happy in last week's cartoon. The scene is Sackville Street, the prominent features of the picture one of the tree guards encircling its moribund charge, and two specimens of humanity. Of these one is Mr. Gladstone in travelling costume, and carrying a bag filled with pamphlets labelled "Vaticanism," and further stuffed with post-cards; the other is a son of the sod. The statesman, addressing the latter, blandly says, "Well, Pat, my boy, I've come to see you, because I can't get on without you; couldn't you think of some good grievance before next election; is there anything I can do for you?" Pat, leering quite innocently, replies, "Well, then, plaze your honour, as you are here, you might as well cut down them trees in Sackville Street," pointing at the same time to the flourishing specimen of municipal arboriculture in view. It is a hint, and well timed, if the hint be taken, and anything is to be done now in the way of replanting, or, if not, removing altogether what are at present an eyesore and reproach.—*Irish Farmer's Gazette.*

LARGE WHITE OAK IN MICHIGAN.—Mr. Dow Lyon, of St. John's, Mich., says he has a white oak growing which at three feet from the ground measures seventeen and a half feet in circumference, and he judges that the first large limb is sixty-five feet from the ground. It is very symmetrical for the first forty feet or so.

From the recently published *Proceedings* of the Twenty-fourth Annual General Meeting of the Scottish Arboricultural Society, we observe that the actual number of New Members elected during the meeting was *forty-six*, a goodly addition to an already numerous and prosperous Society. The financial affairs are consequently in such a healthy state, and so well managed by the energetic treasurer, that the Society is now enabled to invest £300 of its surplus funds, as the nucleus of a sum which it may be hoped will go on increasing annually, until it places the Society in possession of the means for widely extending its sphere of usefulness, and the beneficial influences it is calculated to promote in the prosperity and amenity of the country.

We are much pleased to observe the addition of two important sections to the Office-bearers, viz., Photographic Artists and Local Secretaries. To the former of these offices the eminent artists Mr. John Horsburgh, Edinburgh, and Mr. Magnus Jackson, Perth, are appointed. The Local Secretaries appointed reside in widely separated parts of England, Scotland, and Ireland, each having a district apportioned to him, in which he acts as the Society's representative under the direction of the Council, giving and receiving all information concerning the Society and its objects in the district, and regularly transmitting the same to the Secretary to be duly laid before the Council. Much depends in a Society of this kind, with its members spread throughout the length and breadth of the land, upon the efforts made by its representatives and those interested in its prosperity in the different districts of the country, and we hope the newly appointed Local Secretaries will display an activity and enthusiasm in promoting the interests and influence of the Society worthy of such an important cause. It may be said that the district appointed to each Local Secretary is too large for efficient working; but we have no doubt this will quickly be put right as soon as the system gets into working order.

We see that the subjects for discussion at the next annual meeting

are slightly different from what was stated at page 572 in our report of the last meeting, and are now fixed as follows:—

"1. What is the best course of study to be followed by Students of Forestry in this country. Discussion to be opened by Mr. McCorquodale, Forester and General Surveyor, Scone, Perth.

"2. How to ascertain accurately by measurement the annual growth of the stems of living trees? Discussion to be opened by Mr. Gorrie, Rait Lodge, Edinburgh."

We would strongly recommend the careful study of these subjects, more especially of the first, by all those members of the Society who intend being present at the meeting in November next, so that the discussion may lead to some definite curriculum being adopted by the Society, which it may safely recommend to our young foresters as the *best course of study* to be followed; the want of such a plan has been severely felt, and is at the present time a source of very great difficulty to young foresters in their unaided attempts to acquire a thorough knowledge of their profession.

It is also resolved that an arboricultural excursion, under the auspices of the Society, shall take place during the present year; the scene selected being the celebrated woods and plantations of Scone and Athole, in Perthshire. The day fixed for the commencement of the excursion is Monday, 5th August; the rendezvous being the ancient and Fair City of Perth, so easily reached by rail from all parts of the country, and so conveniently situated in the midst of the famous localities to be visited.

We are also pleased to note several excellent additions to the subjects, for essays and reports upon which the Society offers liberal prizes. The first on the list is a handsome prize placed at the disposal of the Society by the proprietors of this Journal, "For the best and approved Report, describing fully the Tools used at present by Foresters in Britain." This is a subject upon which there is a great lack of information and divergency of opinion amongst foresters themselves, and we trust there will be good competition for this prize, so that many and varied experiences may be compared, and much valuable information elicited upon a subject of the greatest importance to those who have to perform the laborious duties of a working forester. We give on another page a full list of the subjects offered for competition during the ensuing year, the Essays and Reports upon which must be in the hands of the secretary by the 24th of September, and all Collections of Cones, Seeds, Woods, and Geological Specimens, and Rustic Work not later than the 22nd October. Any particulars or information required by intending competitors can be promptly had by applying to the secretary, Mr. John Sadler, F.R.P.S., Royal Botanic Gardens, Edinburgh.

We would particularly recommend to the attention of young foresters the subjects II. (which is limited to "Assistant Foresters" VI., VIII., IX., X., XI., XII., XX., XXII., and XXV., as being quite within the scope of their experience, and for which we trust to seea lively competition. Subjects XIV. and XV. have a special interest for our Indian and colonial friends. Natives of the United States of America and the continent of Europe are specially invited to compete for XIII. and XVI., to whose attention we would also recommend the XXIII. subject. We would like to see subject XXI., "For an approved Essay on the Best Methods of Rearing Timber Trees in Deer Forests for Shelter," taken up and treated in a practicable manner by some one who has had experience in this somewhat difficult but highly desirable operation, especially in the wild glens and on bleak mountain sides of the Deer Forests in the Highlands of Scotland.

Through the courtesy of our esteemed correspondent, Dr. J. Croumbie Brown, of Haddington, we are enabled to lay before our readers some particulars of the increasing interest that is being displayed in forestry, and all that relates thereto, in the United States of America. As we stated last month, there is a Bill at present before the U.S. Congress for the promotion of this laudable object upon a very liberal and comprehensive scale, with every prospect of being passed into law at an early date. From a message sent by the President of the United States to the House of Representatives, transmitting a special report upon the subject of Forestry by the Commissioner of Agriculture, we learn that by an Act of Congress passed on the 15th of August, 1876, the Commissioner of Agriculture was required to appoint some man of approved attainments, and practically well acquainted with the best methods of statistical inquiry, with a view of ascertaining the annual amount of consumption, importation, and exportation of timber and other forest products; the probable supply for future wants; the means best adapted to the preservation and renewal of forests; the influence of forests upon climate; and the measures that have been successfully applied in various countries for the preservation and restoration or planting of forests; and to report upon the same to the Commissioner of Agriculture, to be transmitted by him in a special report to Congress.

In accordance with the terms of this Act, Dr. Franklin B. Hough, of Lowville, Lewis County, New York, was appointed on the 30th of August, 1876, for the performance of this important duty, for the discharge of which he seems to be uncommonly well qualified. He appears to have entered upon his duties with great zeal and enthusiasm, and to have diligently prosecuted his investigations and in-

quiries throughout the length and breadth of the timber-producing regions of the States. Starting from New York, he proceeded through the timber districts in the north of that State and Ohio, crossing Lake Erie from Buffalo to Detroit, in the celebrated timber-producing State of Michigan, visiting the great timber depôts at Bay City, Saginaw, and Grand Rapids; then across Lake Michigan to Milwaukie, and on to Chicago in the north of the State of Illinois, famous for its extensive timber and grain depôts, and its marvellous growth of population and rapid resuscitation from the effects of big fires. From thence Dr. Hough proceeded north, again visiting Freeport and Madison, and right on through the timber districts of Northern Wisconsin to the shores of Lake Superior at Duluth; turning south at this point, and investigating the famous timber-producing regions in the valley of the Upper Mississippi, in the neighbourhood of St. Paul, Minnesota. He next proceeded southward through Minnesota and Iowa to Omaha, and then westward along the timber tracts of the River Platte, in the State of Nebraska; on through Wyoming to the "City of the Saints" in Utah, and up to the top of the Wahsatch Mountains, an elevation of some 12,000 feet above the level of the sea. The Mormons of Salt Lake City seem to have shown the traveller every courtesy, and by the assistance and suggestions of Brigham Young he was enabled to visit and inspect the timber region of the Big Cotton Wind Canyon, from whence they derive their chief supply of timber. Returning east, he visited the Rocky Mountain regions in the State of Colorado, inspecting the various famed timber districts, and then onwards through the State of Kansas to Kansas City, and northwards from there along the Mississippi Valley to Omaha. From there he journeyed homewards through Iowa, Illinois, Indiana, Ohio, and Pennsylvania to New York, having traversed a distance of something like 8,200 miles, in pursuit of the valuable statistics and general information upon the subject which he incorporated in the report now laid before Congress.

To help him in attaining his object, Dr. Hough also entered into an extensive correspondence with the officers connected with the forest management and forest schools which abound in Europe, and from whose matured experience and opinions upon such matters of vital interest he has gleaned a vast amount of valuable information, which he has made excellent use of in his report. The report is accompanied with numerous illustrations of various kinds, beautifully engraved by the "relief-heliotype" process, a novel feature of great interest, and especially so when applied, as it is here, to the graphic method of presenting statistical facts and scientific comparisons when numerically expressed. Besides the chapters which deal with statis-

tical and strictly scientific facts, the author has a wealth of matter, historical and instructive, which will be of interest not only to every forester and landowner, but also to every thoughtful person whose views of life and its duties are not bounded by the narrow limits of his own existence, or whose national pride and patriotism hope for a prosperous future for his country.

The President has also recommended to Congress the appropriation of the handsome sum of $8,000, or so much thereof as may be necessary during the next year, to prosecute these inquiries into the subject of forestry—$6,000 of which is to enable Dr. Hough to continue the work he has already so well begun, and for which he has so much really valuable matter in hand ready to be arranged, as well as to enable him to make personal inspection of European forests, should it be considered advisable for him to do so in the prosecution of his investigations.

From a letter which our readers will find in the "Editor's Box" of our present issue, they will observe that at the request of the Directors of the Highland and Agricultural Society of Scotland, Mr. Robert Hutchison, F.R.S.E., of Carlowrie, ex-President, and a Vice-President of the Scottish Arboricultural Society, has undertaken to comply with the desire of the International Commissioners of the Exhibition to be held at Paris this year, by preparing and forwarding a report on the state of forestry and forest management in Scotland. The matter could not be put into abler hands, Mr. Hutchison's great experience and thorough knowledge of the subject being ample guarantee that it will be done full justice to. We trust Mr. Hutchison will receive the hearty support of all who are interested in forestry in Scotland in carrying out this very important matter.

We also understand that the Highland and Agricultural Society has asked and appointed the following eminent gentlemen to undertake the Report on the Agriculture of Scotland for the same purpose, viz., John Wilson, Professor of Agriculture, University of Edinburgh; Dr. A. P. Aitken, Chemist to the Highland and Agricultural Society; Mr. Robert Scot Skirving, Edinburgh; and Mr. John Wilson, Edington Mains, Chirnside, Berwickshire. We hope the reports for England and Ireland will be put into equally able and efficient hands.

In a comprehensive and interesting lecture recently delivered before the American Philosophical Society, by Mr. E. K. Price, of Philadelphia, upon Sylviculture and its application to the wants of the vast area of the United States, he states some facts in connection therewith with such force and clearness as to render them of general interest, especially to the inhabitants of those countries

which are suffering from the want of a due proportion of forest within their boundaries. Summarizing the most noted examples of the destruction of forests in ancient, mediæval, and modern times, and the numerous evils resulting therefrom—in the decrease of rains with consequent fallen rivers and dried-up brooks, extended deserts, and depleted populations, in many countries in the Eastern hemisphere, he teaches by their example how to avoid the primary cause of such dire calamities, and the urgent necessity that exists for beginning in time to repair the mischief caused by man's ignorance and improvidence. It is beyond a doubt that trees attract the clouds which produce rain, conduct it into the earth, and retain it there for the supply of springs and streams. When trees are felled, the parching heat of the sun dries up the face of the ground, and its moisture is rapidly carried off by evaporation from its bare unprotected surface, instead of percolating through the earth to the reservoirs and channels of the springs, and through them maintaining the brooks, streams, and rivers at a healthy level.

"The facts are abundant, that to part with the trees is to lose the springs they protect, the running streams the springs supply, and the volume of the broad river. These lost, all the charm of the landscape has fled, and then this source of man's refinement and civilization has also left the world. With loss of rains and springs the fruitfulness of the earth passes away. Grass fails for flock and herd, and the bread of life for man is no longer sure, and only because man has betrayed his trust."

Our Indian Government ought to give due attention to such indisputable facts, while it is endeavouring to avert the re-occurrence of famine, to improve the country, and to ameliorate its climate. More efficacious work is to be done by assisting the laws of nature in maintaining a due proportion of forest trees for shade and shelter, and the general amelioration of the climate of India, especially on the hills and higher parts, to attract and retain moisture, and supply water to the lower parts of the country, than can be done by expending millions of money upon costly irrigation works, and the futile attempt to convince water that it is not its nature to flow downhill. A Select Committee is now being appointed by Government to inquire into and report on this and other relative subjects under the Administration of Public Works in India, which will no doubt make a searching inquiry into the existing condition, extent, and distribution of the forests, and the influence which their presence or absence has had upon the climate and rainfall in the different divisions of the country, more particularly in those districts which have suffered so terribly from the ravages of famine in recent years. From the results of such an inquiry, much valuable and most important information will be gained.

Cultural First Principles.

By G. S. BOULGER, F.L.S., F.G.S., late Professor of Natural History in the Agricultural College, Cirencester.

VI. Green Leaves.

(*Continued from page* 608.)

The leaves are at once the lungs, the stomach, and the heart of a plant. A cultivator, then, who neglects the physiology of the leaf is comparable to a physician who leaves respiration, digestion, and circulation out of consideration in diagnosing a disease.

A leaf is a lateral branch of the vascular tissue of the stem-system, with secondary branches united by a web, so to say, of cellular tissue, the whole being covered by an epidermis. It is roughly comparable to the digits of a duck's foot, united by the web of skin. The main vascular bundle passes along the stalk or "petiole," and the centre of the blade of the leaf or "midrib." The secondary branches are termed "veins;" their arrangement "venation." These constitute the "skeleton" of the leaf, which so often remains after the decay of the cellular portion.

A leaf is essentially an expanded surface, an organ adapted for increasing the green surface of a plant, so as to expose to the light and air the greatest practicable amount of cellular tissue containing the characteristic green matter known as "chlorophyll." This substance is situated in the loosely arranged cells in the interior of the leaf, but not in those of the epidermis, which can easily be peeled off, and are then seen to be colourless, containing nothing but air. The green cells below the epidermis of the upper surface of the leaf are more closely packed, and are oblong in outline, being placed endwise, or with their long diameter at right angles to the surface of the leaf. It is on this account that the upper surface of leaves is commonly darker than the under surface, and the arrangement of the cells so as to expose the least possible surface is designed as a protection for the underlying cells from the too powerful evaporating action of direct sunshine. This provision is even more complete in evergreens and plants of arid climates, there being in such cases two layers of these oblong cells very compactly arranged. The cells below these are loose, with numerous and large interspaces, which contain air.

The epidermis is a further check on evaporation. It is composed of thick-walled cells, commonly in one layer, but sometimes even in three (as in the oleander).

Some exhalation of water-vapour from the leaves is, however, essential, as the only method by which the excessively diluted food absorbed by the roots can be concentrated. This is permitted and regulated by a vast number of curious "breathing-pores" or "stomata." Each of these usually consists of two cells, curved towards each other like the two sides of the letter O, which are modified epidermal cells, and form an opening communicating with the intercellular spaces. In moist air these cells swell out and enlarge the aperture, whilst as they become drier they shorten and straighten, so as to close it. But the surrounding cells, differing in form, have a contrary influence, so that the result is that of two opposing forces. Stomata occur chiefly on the lower surfaces of leaves away from direct sunshine; thus leaves soon wither when artificially reversed in position. Stomata do not occur on leaf-surfaces in contact with water, where evaporation is impossible. They vary in number from a few dozen up to about 170,000 to a square inch. An apple leaf has about 100,000, one of lilac 700,000, whilst the larger lime has over a million.

To enable it to shed water readily, the surface of leaves is commonly protected by a thin natural varnish of wax, or by a powdery "bloom" of this substance, as in the cabbage, on which water runs like mercury.

When leaves remain on the tree through the cold season, and until after the appearance of new leaves, so that the stem is never leafless, they are termed "evergreen." In these cases, however, as in deciduous trees, they often last only a year, withering or falling soon after the expansion of the new ones. In conifers they remain on the tree from two to eight, ten, or even twelve years.

Some leaves wither, but do not fall, whilst others fall unwithered. The fall of the leaf is owing to the formation of an articulation, or joint, as under the influence of a surgeon's ligature. The death of the leaf, on the other hand, is due to the choking of its cells and the vessels of the petiole by the mineral matter brought in solution in the water absorbed by the roots, just as in very old human beings the aorta, or great left artery of the heart, becomes choked with bony matter. Chemical modification of the chlorophyll causes the varied hues of autumn. This mineral matter, which renders leaves useless physiologically, also renders them valuable as manure. The dried leaves of the elm contain more than 11 per cent. of mineral matter, while the wood contains less than 2; those of willow more than 8 per cent., against 0·45 in the wood; those of beech 6, against 0·36; those of oak, 4 against 0·2; and those of pitch pine, 3·15 against 0·25.

The warmth of the sun, or of a dry atmosphere, causes evaporation from the leaves. This is very variable in amount, but 22 ounces avoirdupois have been recorded as exhaled in twenty-four hours by a sunflower, which exhibited 39 square feet of surface. This evaporation causes an upward flow of the watery sap with its mineral constituents.

Air has free access into the intercellular spaces of the leaf by means of the stomata, and the green chlorophyll has the peculiar property, when under the influence of sunlight, of "fixing" or assimilating the carbon of the carbonic acid in the air and returning the oxygen. Thus plants purify the air by removing a noxious and restoring a life-supporting gas, and thus they acquire the carbon necessary for their own nutrition and growth. This carbon, combined with nitrogen and the elements of water, passes as the "elaborated sap" to the growing parts. Thus are the leaves both stomachs and hearts.

But, like animals, plants also require to breathe, *i.e.*, to inhale oxygen, which combines with, or burns, part of their food supply, just as the oxygen in our blood burns our tissues. Carbonic acid is thus formed and exhaled (though in far smaller quantities than it is taken in), and thus the leaves are lungs, since they perform this function also.

One obvious practical conclusion is that trees are in a far more active state of vitality when their leaves are just formed than when they are withering or fallen, and must be dealt with accordingly.

Obituary.

We regret to have to record the death of Mr. Robert Foulis, gardener, forester, and overseer at Fordell, Fifeshire, where he had faithfully served successive proprietors for the long period of over half a century, and died there on the 21st December, "full of years and honours." He had lived to the great age of fourscore, and till within a few weeks of his death was as active and energetic in the discharge of his duties, and as well informed upon current professional affairs, as most men are in the prime of life. He was esteemed and beloved by all who knew him, and was well and honourably known as a most successful gardener, an enthusiastic forester, and a keen farmer, with an extensive knowledge of many of the kindred sciences. He was awarded the Neill prize by the Council of the Royal Caledonian Horticultural Society in February, 1876—a well-merited honour, and one which he highly appreciated. And last, but by no means least in his estimation, was the complimentary dinner given him by his friends in Edinburgh in October last, when he was presented with a valuable gold watch and purse of sovereigns, on the occasion of having completed his fiftieth year's service at Fordell.

Drainage.

By ALFRED J. BURROWS, Pluckley, Kent.

The subject of drainage has already been incidentally alluded to in these pages, but more especially in its connection with and application to woodlands. The whole question is, however, one of such vital importance to the landowner, the forester, the gardener, and the agriculturist, that a few remarks upon it may not be unacceptable to the readers of the Journal of Forestry.

Though the geological formation of any particular district may afford some general data for the arrangement of a system of drainage, the practical man will be guided more by the results of his own observations of the state of the land itself, as shown by its vegetation and the crops it yields.

The primary objects of all drainage operations should be to lessen the cost of cultivation, and at the same time to increase the yield of land in respect to both quantity and quality.

The amelioration of climate, and the increased healthiness of a district thoroughly drained, are by no means unimportant factors in a calculation of the economical advantages of the system.

Among the many evils resulting from a superabundance of stagnant water in the soil may be enumerated the following :—

1. The extra cost of cultivation, and the increased difficulty—amounting in very wet seasons to an impossibility—of obtaining a proper seed-bed for the reception of nursery stock, or of farm and garden seeds. From the exclusion of heat and air much of the seed put into wet soils does not germinate.

2. The lateness of the harvest upon corn lands, and the uncertainty as to the maturing of new growths of wood, whereby they are often unable to stand the severity of winter or the frosts of spring.

3. The slow decay and consequent inactivity of manures applied to the land, much of the virtue of which is washed out of the soil and wasted instead of being appropriated by vegetation.

4. The coldness of the soil, caused by nearly all the sun's heat being expended in evaporating water, and by the exclusion of warm air and the warm spring and summer showers.

5. The production upon pasture land of inferior grasses, containing little nutriment for sheep and cattle, and yielding poor crops of

inferior hay. The rot in sheep and some of the diseases in cattle are clearly traceable to the effects of wet pastures.

6. The low temperatures of the plants in summer, caused by the increased evaporation from their surface of the superfluous water taken up with their organic food, and the consequent slowness of all essential chemical changes in the body of the plant.

7. Disease in timber, and more particularly in the larch, and the lodgment of corn crops—more particularly wheat—from their becoming what is called root-fallen before harvest. In many cases rottenness of heartwood and stag-headedness in timber are seen to be the results of excessive moisture in the soil.

Among the many beneficial results of drainage may be mentioned—

1. The increased friability, and therefore more easy and complete pulverization of the soil, which not only renders every particle of nourishment contained in it available for root-food, but also admits air, without which vegetation languishes. In thoroughly drained and well-worked soils the interspaces amount to one-fourth of the whole bulk, so that when cultivation extends to a depth of eight inches there will be in every acre of ground 12½ millions of cubic inches of space available for the supply and circulation of air, and every extra inch of depth broken up calls into activity upon the same area about 235 tons of fresh soil.

2. Deep drainage, by the removal of the water from the subsoil, causes the descent of that in the upper stratum, which sucks the air down after it; thus every fall of rain dislodges and afterwards causes the renewal of the air.

3. Rain brings down from the atmosphere ammonia, nitric acid, carbonic acid, and saline particles, which enrich the soil. Electricity generates the two former in the air, and the lower layers of a fall of snow are particularly rich in ammonia. When rain-water flows off the surface of land, it not only carries these substances to the nearest brook, but also washes the soluble parts of manure from the soil.

4. In well-drained land vegetation gets an earlier start in spring, makes more rapid and larger growth, and attains an earlier maturity.

5. Drainage equalizes the temperature throughout the soil, as the warmth of the air and of the upper soil is carried down to the lower strata. It also promotes healthy growth by enlarging the ranges of temperature from the heat of summer to the cold of winter. In very wet land the temperature rises so little in summer that the range throughout the year is seldom more than 10°, unless during a season of drought a soil becomes baked, and cracks or opens. Upon moderately dry soils, on the contrary, the range is often as much as 35°; and Humboldt tells us that between the tropics the heat of the soil often rises above 124°.

6. Upon drained lands, when the bottom is well stirred or subsoiled, the descending water removes many substances injurious to vegetation, such as the protoxide of iron, which forms in wet land, below the depth of cultivation, a hard pan impenetrable to air, water, or the roots of plants.

7. Moderately deep drainage renders deep cultivation both easy and necessary; for as more soil is rendered available, roots penetrate deeper and are less affected by drought.

8. By the free admission of air more carbonic acid is generated in the soil, and all vegetable substances contained in it are decomposed more rapidly; hence naked fallows become unnecessary, and the rotation of crops may be enlarged.

9. On pasture lands the inferior grasses die out, and are succeeded by others of better quality; the result is sounder sheep, a larger clip of wool, and better hay.

Though there are few districts in which land is not greatly improved by judicious drainage, its beneficial results are more marked upon the argillaceous soils, where infertility is caused mainly by the properties those soils possess of resisting for a long time the penetrability of air and water, and by their retaining water once admitted so long as to cause it to become injurious. When undrained, the siliceous or sandy soils also often remain infertile, in consequence of their retaining so little moisture that the sun's heat injures the roots of plants. The breaking up of the subsoil by drainage and deep cultivation places the roots beyond the reach of excessive heat.

Among the limestone formations, chalk, which is an earthy carbonate of lime, generally requires drainage. From its whiteness it reflects instead of absorbing the solar rays. Most of the calcareous soils, however, are rich in vegetable matter, or humus, which is completely insoluble in water, and is only obtainable by plants when it becomes mixed with the oxygen of the air.

A healthy state of siliceous, aluminous, or calcareous soils is that in which, while their pores are charged with water, the interstitial canals, or spaces between the clods, are free, in which condition they will crumble to pieces in the hand.

Much difference of opinion exists as to the general depth of drainage; and while many theorists advocate a uniformity of 4 feet, there are excellent authorities who recommend a variation of from 2 feet 6 inches to 4 feet 6 inches, according to the texture of the soil. It is but seldom that the error is on the side of excessive depth. As long ago as the time of the Commonwealth, Captain Walter Blythe wrote, "And for thy drayning trench it must be made so deepe that it go to the bottom of the cold spewing moyst water that feeds the flagg and rush, a yard or 4 feet deep if ever thou wilt drain to any purpose, and one spade's graft beneath."

One great object of draining being to prepare the way for deep cultivation by steam or otherwise, and as subsoiling may penetrate to a depth of at least 2 feet, a drain of 2 feet 6 inches in depth should be the minimum on arable land. But no one of large practical experience will attempt to lay down hard and fast rules applicable to all soils, either as regards depth of drain or distances apart. Local experience alone can decide these points. In the stiff clays of the Weald, drains 3 feet deep and 18 feet apart have been productive of the most satisfactory results, while good authorities maintain that upon many of the heavy Norfolk lands, 2½ feet deep and 22 feet apart answer best. The main reason why deep drainage of clay lands has often proved unsuccessful is, that as the depth of drain was increased, the intervals between them were proportionally widened, for no other apparent reason than that of equalizing the cost price per acre!

The following table, which approximates to the principles of drainage recommended by the General Board of Health, will give the reader a better idea of the range of prices upon various soils than the most lengthy description. The cost of pipes or draining tiles is reckoned at 30s. per thousand.

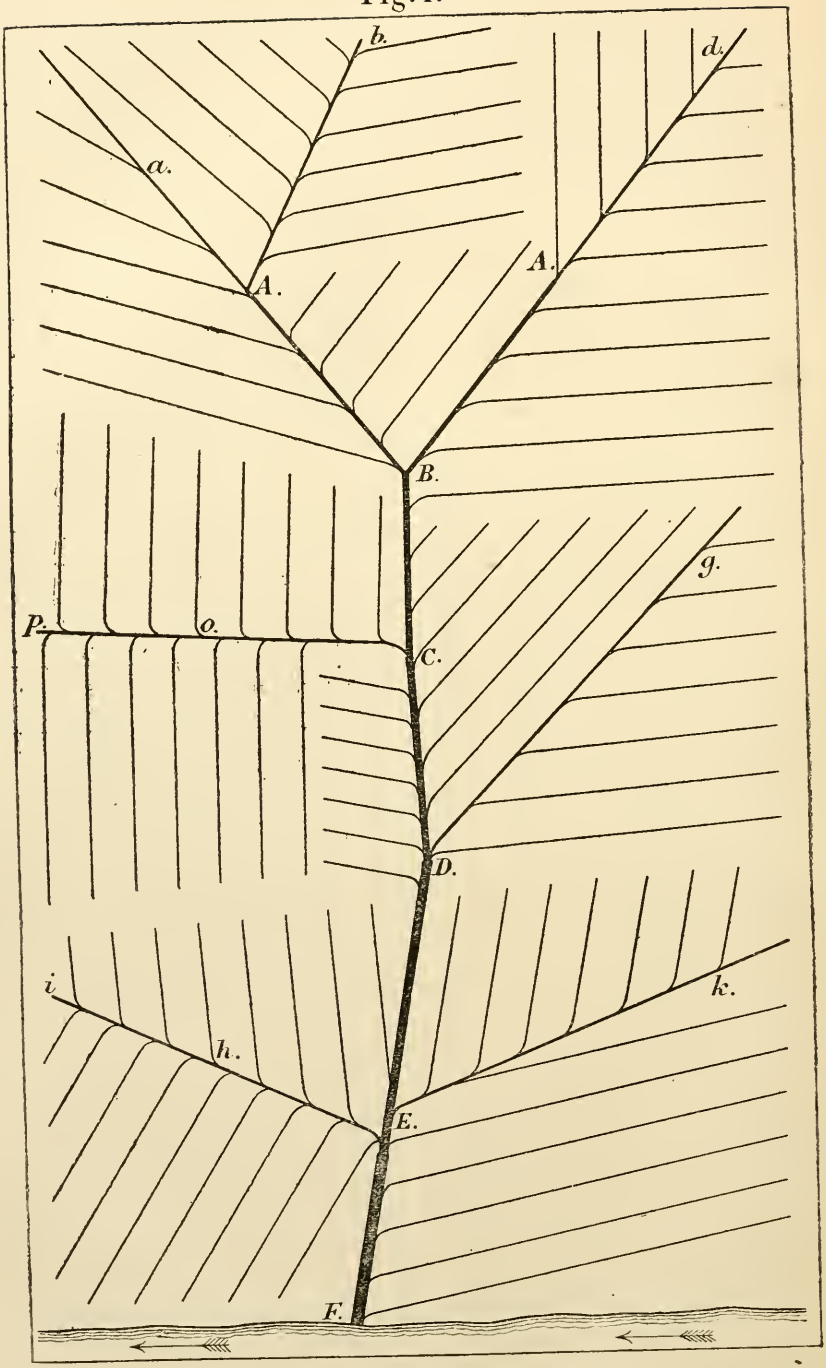
COST OF DRAINAGE PER ACRE.

Kind of Soil.	Distance.	Depth.	Yards per Acre.	Cost per Chain.	Cost per Acre.	No. of 12 inch Pipes.	Cost of Pipes.	Total Cost per Acre.
				s. d.	£ s. d.		£ s. d.	£ s. d.
Heavy Soils: Hard gravelly Clay	15 ft.	2 ft. 6 in.	968	1 8	3 13 4	2,905	4 7 2	8 0 6
Adhesive ,,	16½ ,,	2 ,, 6 ,,	880	1 7	3 3 4	2,640	3 19 2	7 2 6
Friable ,,	18 ,,	2 ,, 9 ,,	807	1 6	2 15 1½	2,420	3 12 7	6 7 8
Soft ,,	21 ,,	2 ,, 9 ,,	692	1 4	2 2 0	2,076	3 2 3	5 4 3
Medium Soils: Clayey Loam...	22 ,,	3 ,, 0 ,,	660	1 8	2 10 0	1,980	2 19 5	5 9 5
Marly ,,	24 ,,	3 ,, 0 ,,	605	1 6	2 1 3	1,814	2 14 5½	4 15 8
Gravelly ,,	29 ,,	3 ,, 3 ,,	538	2 4	2 17 2	1,613	2 8 4½	5 5 6½
Friable ,,	30 ,,	3 ,, 3 ,,	484	2 0	2 4 0	1,452	2 3 6½	4 7 6½
Light Soils: Gravelly Loam.....	33 ,,	3 ,, 6 ,,	440	2 10	2 16 8	1,320	1 19 7	4 16 3
Marly ,,	36 ,,	3 ,, 9 ,,	403	2 8	2 9 4	1,209	1 16 3	4 5 7
Sandy ,,	39 ,,	4 ,, 0 ,,	373	2 6	1 19 8	1,117	1 13 6	3 3 2
Soft light ,,	42 ,,	4 ,, 0 ,,	346	2 4	1 16 9	1,037	1 11 1½	3 7 10½
Sandy Soil.....	45 ,,	4 ,, 0 ,,	325	2 4	1 14 5	974	1 9 2½	3 3 7½
Light gravelly Sand	49½ ,,	4 ,, 3 ,,	293	3 4	2 5 0	880	1 7 4½	3 12 10
Deep ,, ,,	55 ,,	4 ,, 3 ,,	264	3 0	1 16 0	792	1 3 9	2 19 9
Coarse ,, ,,	60 ,,	4 ,, 6 ,,	242	4 0	2 4 0	726	1 1 9	3 5 9
Loose ,, ,,	66 ,,	4 ,, 6 ,,	220	3 4	1 13 4	660	0 19 9½	2 13 1½

At the present day there exists but little difference of opinion as to the best form of drain for arable and pasture lands, for the pipe drain has superseded every other mode. Stone drains of all sizes and of almost every conceivable form have been extensively tried where the material has been abundant; but none of them approach the perfection of a well-laid round or oval pipe drain. These, when sufficiently protected at the outlets, are almost indestructible.

For feeders the 2-inch pipe is almost universal; but the capacity of the mains must depend upon the nature of the soil, as the more porous this is the quicker will the pipe be filled; while the more rapid the fall, the smaller the pipe required, as it will the more

Fig. 1.



speedily discharge itself. But except in the case of iron pipes, socket pipes, or pipe and collar, a rapid descent is undesirable, as in the event of the slightest derangement in the bedding of the drain, the channel washes away and stoppage ensues. Of the two evils it is better to err on the side of over-capacity. It may here be observed that it is never desirable to fill a drain quite to the top with stone, as in such a case the water carries down sand and particles of other matter, which soon cause it to silt up.

The following, which is taken from a treatise on "Land Culture" by G. A. Dean, Esq., shows the approximate number of acres which main drains of various sizes are capable of draining, the annual rainfall being estimated at 30 inches:—

Size of Pipe.	Acres Drained.		
	Heavy Clay.	Medium.	Porous.
3 inches	6	5	4 to 5
4 ,,	9	8	6 to 7
5 ,,	16	15	13 to 14
6 ,,	25	23	20 to 22
7 ,,	35	32	30
8 ,,	46	44	40
9 ,,	60	54	50
10 ,,	75	67	60
11 ,,	91	80	70
12 ,,	109	94	80

In order to render the above arrangement of main drains as applied to various areas more intelligible, we give the preceding illustration (Fig. 1) of an oblong field of heavy clay land, 60 acres in extent, and which can be drained by one outlet only, and that into the river at F, the mains being in every case laid along the hollows, and being proportioned throughout to the quantity of water they may have to discharge.

From A to a, A to b, A to d, o to p, D to g, h to i, E to k = 3 inches.
,, AA to B, C to o, E to h = 4 inches.
,, B to C = 6 inches; C to D = 7 inches.
,, D to E = 8 inches; E to F = 9 inches.

By carefully following the arrangement in the above plan it will be seen that the capacity of the main drains gradually increases from A to F. And it should be observed that the larger the pipe used and the greater the pressure of water, the less may the fall be made.

The laying out of drains should never be attempted by the eye alone; but the whole thing should be done in a systematic way by the aid of a spirit level. Stumps being driven in all along the mains, at distances of one chain apart, or less if required, and the whole field carefully laid down to a scale, the plan should be put aside for reference in case of any stoppage or future derangement. And before

the pipes are laid the whole course should be carefully gone over with the borning rods to see that the proper fall is obtained.

Upon very flat districts it is sometimes almost impossible to obtain a proper fall, except by deepening the cut considerably towards the mouth of the main drain; and though 1 in 1,000 will discharge water, it is better to secure at least 1 in 100, in order to insure the permanent usefulness of the drain.

Though it may not be desirable to make too large an area depend upon the outlet, yet when the work is efficiently planned and well executed, the fewer mouths the better. As soon as the soil is well settled down, these should be faced up with brick or stone work, and cross-barred to exclude vermin. It is also of the greatest importance to have all main drains, and indeed covered drains of every sort, far removed from the roots of elm, ash, and willow trees.

By careful arrangement the whole system of field and road drainage may be made subordinate to one general scheme of district drainage; and in this way the necessity of leaving wide open ditches by the sides of roads may be obviated, as the area of these is seldom less than three quarters of an acre to every mile of public road.

The channels of all main drains should be cut lower than those of the feeders, say 2 or 3 inches, according to circumstances; and all delivery should be in the direction of the flow, and never at right angles to it. Nor should any two side drains ever discharge into a main exactly opposite to each other.

The general principles of drainage are the same in all cases, whether applied to arable or pasture land, or to woodlands; but as the system generally adopted in the latter is that of open ditches, there is little fear of going too deep with these in the impermeable and highly retentive soils.

Picea Nobilis Seedlings.—On clearing a border on which I have a very good and tall *Picea nobilis* my gardener found three seedlings from it, evidently of one, two, and three years' growth, grown under some holly trees which stand close by. I am well acquainted with growing seed of this tree, as I now have seedlings six feet high, but to do this they have to be sown and carefully preserved under cover until fit to move. I am given to understand also that the seed never ripens properly in this climate, but my experience appears to point to the opposite. The parent tree itself gives every year large numbers of cones which have to be cut away, or their weight might break the branches if allowed to remain. Have any of your correspondents met with a similar occurrence—viz., trees growing from seed without any protection?—Fred. Walton, St. Cuthbert's, Albrighton, in *Journal of Horticulture.*

Hedges and Hedging.

By D. TAIT, Wood Manager, Owston Park, Doncaster.

The proper management of hedges is of great importance, as in some shape or other there is connected with them a considerable amount of labour, differing in degree according as they have been properly managed from the time of planting, or neglected altogether. To be useful as a fence it is requisite that they be properly planted, and have due attention paid to their well-being year by year thereafter. Whether as a fence they will be as often chosen in the future as in times past is extremely doubtful; in fact, it is certain they will not, as the introduction of wire and iron for fencing purposes has developed a fence in many ways superior to hedges. For landscape effect, however, and for shelter, they will always be in requisition. Of the many plants suitable for hedges the common thorn or quickset is by far the most extensively used, and, as may be inferred, is the most useful for forming a fence against stock.

On estates possessing a home nursery the plants may be raised from seed, by collecting the haws when fully ripe and burying them in a sand-heap for fourteen or fifteen months; that is, if they are gathered in the end of October or beginning of November they require to remain in the rot heap till the second following January or February; the hard seed-cases render this treatment necessary, and if sown earlier would only take up the ground without any benefit. They may also be bought in as one year's seedlings at a trifling price. Their subsequent treatment in the nursery is much the same as other plants; the one thing to look to is to give them plenty of room; and the oftener they are transplanted the better they will thrive when planted out. Where there is no home nursery, plants that have been twice transplanted after being drawn from the seed-bed should be used, the point being to have them with good roots.

The ground on which the hedge is to be planted should, if possible, be trenched over the autumn previous to planting, and if there are any inequalities in the line of fence, the ground should be levelled to correspond with the land adjoining.

There are many hedges planted in a single line, but in my opinion a better fence is obtained by planting a double line of quicks, and in after-years, when the fence requires to be cut back, by doing one side

a year or two previous to the other, a good fence is preserved, and a better chance of getting up a good supply of young wood from the bottom. In planting two rows, the line should be stretched along and a trench taken out the required depth; care being taken to insert the plants as deep in the soil as they have been before, the one row should be planted and finished off. A good distance to put the plants in the row is eight inches apart. The line is then run along six inches from the row of plants already put in, at the opposite side to which the roots are laid; the other row is then planted, care being taken to have the *plants* in the one row opposite the *spaces* in the other. Another and more expeditious method of planting is to run the line along where one row of quicks is to be planted, and make a slight mark with the spade as a guide to the planter, who with a boy to put in the plants proceeds in a somewhat similar manner to notching with the L notch; the ground being previously prepared admits of the spade being got deep enough to suit the requirements of the plants.

In situations where rabbits and hares are not too plentiful, it is a good plan to cut the plants over three or four inches from the surface of the ground, which causes them to throw out strong shoots the first season following, and forms a thick compact fence close to the ground.

The next point is to keep the ground clean by forking it over two or three times during the season; but where game is plentiful this requires to be done cautiously, otherwise the plants will get all eaten off, or the bark gnawed off so as to render them useless. In such cases it is best to fork the ground over and clean the plants thoroughly in May, and then let them remain till next spring; even if there is not much grass or rubbish grown up by September to hide the plants, rabbits are not so liable to interfere with them as when the ground is newly forked over, as a large amount of the mischief done by them seems to originate in their sporting propensities, and newly turned-up soil has a great attraction for them.

Unless the plants grow extra strong they will not require anything in the way of switching for the first three years, after which they should be switched up at the sides so as to bring them to the desired shape, but the tops of the plants should not be interfered with till they attain the height the fence is required, which, if for cattle, should be four feet; if round fields under a rotation of crops, or a fence for sheep only, the fence will be high enough at three feet. But whatever the height is, the fence will be sooner formed by leaving the plants uncut at the top till that height is attained. The hedge will have done very well if able to stand alone as a fence in from eight to ten years after being planted. I have not said anything about fences

to protect the hedge when young, but of course that is a necessity in all cases, and adds greatly to the expense of getting them up.

A hedge managed in the way I have set forth will require nothing more but a yearly switching for a considerable number of years, but in mixed husbandry it is sometimes desirable to let them remain two years without topping, which not only forms more shelter, but when pastured by sheep is a great protection to the fence as well.

In pastural farming, and especially on a bare exposed tract of country, it is common to let the hedges run wild for many years for the sake of shelter. If this were only done for four or six years there would be little harm done to the fence; but when they are allowed to grow longer the fence is apt to get bare below, and the plants have a tendency to die out.

In this part of the country when fences get overgrown it is a common thing to have them laid or "plashed," which no doubt is a way to make the best of a bad bargain. The necessity for such treatment is the result of mismanagement at an earlier period of their existence. But, notwithstanding, it is a fact that we often meet with hedges that have been allowed to run wild, and if they have got very open and have a lot of "gaps" in them, the best plan is to have them plashed. There are different ways of doing this work in different parts of the kingdom, but the way it is done here is as follows:—The hedge is first cleared of all dead wood and extra shoots that are not required for layers; the best plants and those in the straightest line being reserved for that purpose. The plants are then cut nearly through a few inches above the ground, with a long sloping cut downwards and bent over at an angle of about forty-five degrees; the bottom part of the cut is then taken off with a slope upwards and neatly dressed off; small hedge stakes from an inch to two inches in diameter are driven in along the line of fence about twenty inches apart, and when layers in the fence are scarce, the deficiencies are made up by filling in with dead thorns twisted through the stakes so as to make the hedge sufficient to turn sheep. The tops of the stakes are then cut off to the required height, and are fastened firmly together with small rods twisted round each other, and backwards and forwards along the tops of the stakes forming a sort of basket work, making a firm fence for two years, by which time, if the hedge grows well, the young shoots will have grown up through the layers, and be able to support them without the aid of fresh "bindings." Bindings are cut out of the woods when they are "brushed," and tied up in scores and sold at sixpence per bundle, and should be about ten or twelve feet long. When a hedge is laid, the "brush" or layers should be put to one side, so as to leave the stools light and air, which will enable them with greater vigour to throw out young shoots, which

at the same time will not be so liable to be smothered as when the layers are laid along on the top of the stools; but here again the "game" consideration comes in, and where it is plentiful it is advisable to protect young shoots by laying the "brush" along exactly in the old line of fence. Such work in this district costs about two and sixpence per chain; and although I do not recommend it as a necessary part in the management of good hedges, still I have often found it useful in making the best of a previously neglected hedge.

A hedge properly trimmed year by year is a long time before it requires any severe cutting back. But if it is done in a rough and ready manner by any sort of labourer, with the first implement that comes to hand, it soon gets bulged out, and not only looks slovenly, but if treated for a few years in such a fashion the fence will be ruined, and require no end of patching when it comes to be cut back. Tenant farmers, whose interest it is as much as their landlords to have good fences, are often very careless about the treatment of their hedges, although many of them are quite the reverse. Now I would suggest that when a farmer has not a qualified hedger among his own labourers, he should employ the best hedger in the district, and let him do the work by contract, at so much per chain, and not only so, but let the contract be for a certain number of years, say seven or ten. I have known such an arrangement succeed very well, and the result will certainly be more satisfactory than sending, say, some Irishmen with their reaping-hooks (as I have seen farmers do in wet weather during harvest) to hack and smash at the hedge in any sort of fashion.

I have also seen others than Irish harvest-men making very rough work at hedge trimming. Imagine a man armed with an implement like the reaping-hook stuck on the end of a handle six feet long, and swinging round his head with both hands, operating on hedges seven or eight feet high and nearly as broad, and getting over something like fifteen chains per day, and you will be able to form some idea of the quality of work done.

Where a hedge has been roughly treated for several years the best thing to do is to cut it close back, and a good hedger in doing so will take care to put it into proper shape, keeping it straight both along the sides and top, the height depending on what is required of the fence. If between arable land, or a plantation and arable land, the fence may be cut considerably lower than if next pasture land grazed with cattle: in the former case both sides may be done in the same season; in the latter it will be found best to do one side one year, and the other two years afterwards. Such work is here called "scotching," and costs from a shilling to eighteen-pence per chain.

Where from one cause or another a hedge gets very bare at the bottom, it is sometimes advisable to cut it over six or eight inches

from the ground, but this treatment will be rarely necessary if the hedge is properly cared for from the time of planting.

Hedges in a situation where tidiness is an object require to be trimmed twice a year, once in June and again in September.

The best tool we have for topping hedges is a bill, known as the "Dunse make," with the entire blade of steel, being made very light for trimming one year's growth and heavier in proportion to the work required of them. They can be had from any of our leading nurserymen.

Since the introduction of railways, hedges have been planted over a wide extent of country, and in most cases a good deal of attention is paid to them by the different companies; the soil is generally dug over near the roots, and grass and rubbish prevented from growing up through them and preventing a free circulation of air. Although such treatment is rarely advisable at a plantation side, where practicable those fences situated on arable land would be much better to be so treated. The hedge would not only benefit, but weeds would be prevented from seeding, and consequently be a means of keeping the land clean.

(*To be continued.*)

Pruning Evergreens.—The facility with which strong growing and hardy evergreens may be pruned, or brought into shape by pinching back, is well known. A more systematic experiment in giving a fine growth and symmetry of form to an injured and distorted Norway spruce, is described by Gen. W. H. Noble in the *Gardener's Monthly*. The tree was forty feet high, and had lost many of its outer branches by an unusual drought and an intensely cold and cutting winter storm, and had become enfeebled in vigour. A year or two later a systematic spring pruning was given—first by taking off eight feet of its top down to dormant buds and small tassels just above a tier of small limbs. These limbs were cut back to the tassels of side shoots nearest the trunk, and so on all the way down the tree, each a little longer than those above, giving the tree a slender conical form. Some limbs were taken entirely out. The result was entirely satisfactory. The little tassels swelled out with a graceful droop, and the whole became covered with robust verdure. We tried a somewhat similar experiment on hemlocks twenty feet high, which were becoming thin below by too much shading, with entire success—taking care to leave at every cut enough of the small green foliage to start a new growth.

Removing Stumps.—The following recipe has proved very successful in the backwoods of America for removing the stumps of trees. In the autumn bore a hole of one or two inches in diameter and about 18 inches deep; put in 1½ ounces of saltpetre, fill with water, and plug up close. In the following spring put in the same hole half a gill of kerosene oil, and then light. The stump will smoulder away without blazing, and the fire will go to every part of the roots, leaving nothing but ashes.

Noxious Gases *versus* Vegetation.

By ANDREW SLATER, Rose Cottage, Loftus-in-Cleveland, Yorkshire.

The evils arising from the gases generated by the mining and preparing of ironstone for smelting are painfully apparent in Cleveland plantations. There is no kind of tree on this estate, within a mile of these operations, but is more or less damaged by them, except the Black Italian Poplar.

There is a deep ravine running from south-east to north-west, with a brook flowing along the bottom, which divides this estate from the estate of Liverton, and on the north-west point of that estate mining operations have been carried on for the last eight years on an extensive scale. There is a large fan, worked by steam, for driving fresh air into the mine, and also seven circular kilns in which the ironstone is calcined previous to being sent to the blast-furnaces. The ironstone contains a large per-centage of sulphur and phosphorus, and the gases arising from the burning of these substances are carried by the wind, and their smell can even be detected at the distance of two miles from the works.

On the opposite side of the ravine from the works there is a plantation twenty acres in extent, and sixty years old, consisting of oak, elm, ash, beech, plane, horse-chestnut, Spanish chestnut, lime, holly, hazel, black Italian poplar, Weymouth pine, common and silver spruce, larch, and Scotch fir, all of which, except the poplar, were killed, and have been cut several years since. The poplars stood at least thirty feet above the surrounding trees, and were in no way damaged, while the others had the appearance of being scorched by fire, and altogether had a forlorn-looking aspect. Before the wood was cut, the hedge on the northern boundary of the plantation was thriving well, but since the wood was cut it is nearly all dead, and wire and other fences erected in its stead. Within the same enclosure as the above, two acres had been cut and planted ten years ago with black Italian poplar, with larch and Scotch fir as nurses. The nurses are nearly all dead, but the poplars are doing well, and are from twenty to thirty feet high, and of proportionate girth. They stand within three hundred yards of the kilns, and are in no way sheltered from them. Although the poplars thrive when established

in the ground before being assailed by these gases, I do not find them do so when planted in an atmosphere vitiated by them. Prompted by the hope that poplar might succeed where nothing else would, we planted fifteen acres with it where larches had failed, but very few have done any good, and more than half are dead; the ground is a cup-shaped hollow with one outlet, which unfortunately also serves as an inlet for the smoke and fumes from an adjacent ironstone mine. There are also two brick and tile works close to the plantation, and the fumes from them have the same smell as from the calcining of the ironstone. The clay of which the bricks are made is of a dark-brown colour, contains a large amount of limestone, and has to be ground in a mill before being made into bricks, as the limestone would burst them when burnt and exposed to damp. There is a large amount of coal used in burning the bricks, but there must be sulphur in the clay, to account for the disgusting fumes emanating from them. There are about two acres of elm, forty years old, within one hundred yards of these works, and the tops of the trees are more than half dead. There is another plantation north of the first-named, and separated from it by the Saltburn and Whitby Road. It is now exposed to the fumes from the kilns and the smoke from two ironstone mines, one at each end of the plantation, and both using fans driven by steam for forcing fresh air into the mines and driving out the foul air as well. Since these fans were erected the trees have ceased to make wood, except very small spray on the branches, with few leaves, and these of a sickly appearance, and very small. There are several poplars in different parts of this wood that are in no way tainted, but the ash, elm, oak, plane, and elder, are fading yearly, and in three years hence at most will totally succumb and have to be cut, and it is even doubtful if the oak will part with its bark then. The larch, Scotch fir, common and silver spruces were cut two years ago, all dead.

On the estate of Upleatham there is a plantation about one mile long, facing Marske by the Sea. At the bottom of the slope on which the plantation stands there are three ironstone mines, with a fan and two engines working at each mine, and before the fans were used large circular shafts were sunk, at the bottom of which large furnaces were kept going night and day for ventilating the mines. These were placed almost close to the wood, and one of them at a part of the wood composed entirely of larch, which it killed. The other part of the wood is composed of beech, oak, elm, ash, and birch, with a few larches mixed among the others, but most of the latter are dead, and the hardwood has ceased to make any perceptible growth. The plantation stands high above the works, the slope is very steep, but is exposed to the north, north-east, and north-west winds, which drive the smoke and gases up the slope till the wood is often hidden

from sight. There is no provision made at any of these works for preventing either smoke or gas from leaving them on their errand of destruction.

If properly constructed screens were erected at the calcining kilns the noxious gases could be prevented from escaping from them, because sulphuric acid gas is $2\frac{1}{5}$ times heavier than common air, and does not rise much above the top of the kilns, but when caught by a strong wind it is carried to a distance of two miles or more, where as already stated it has been detected by the smell. There is a small cabin at one end of the kilns (which are in a line, with rails on the top), where the waggons are lowered after being emptied, and here the man in charge had geraniums growing and blooming as well as they would do anywhere else. The bottom of the cabin is about eight feet above the level of the top of the kilns. The manager's house is within three hundred yards of the works, and between it and them there is a rise in the ground on which the miner's cottages are situated. They are of two stories, and form a perfect screen on the south-east side of the works. There is a border at the manager's house, above one hundred yards long, planted with Lombardy poplar, Austrian pine, *Thujopsis borealis, Cupressus Lawsoni, Thuja aurea, Rhododendron ponticum,* common laurel, and dwarf roses, and all are growing vigorously, with no appearance of blight on any of them, and the roses had the best blooms last summer that I have seen for many a day.

Compensation can be obtained for the damage done to woods, but not without trouble and expense on the part of the owner, and where the damage is caused by different firms, the difficulty in recovering the loss is increased. It would be better to prevent the damage being done. I cannot understand why any man, or company of men, should be allowed to destroy the property of their neighbours; while others in large towns are compelled by law to prevent by every known means the emission of smoke or hurtful smells from their works, it would be as easy to prevent them from polluting the atmosphere in the country, and I maintain that unless the necessary means are adopted their works are not complete. The proprietor of woods who has the misfortune to have his property within the influence of these noxious gases has no choice, but is compelled to cut down his woods or lose them. By their removal, the shelter to the adjoining lands is lost, and in addition to the storms, they are exposed to the damaging effects of the gaseous fumes, thereby lessening the value of the crops, which cannot be matured in either straw or grain, and the live fences being killed, other fences have to be erected, less calculated to afford shelter for either stock or crop. The amenity of the estate is greatly impaired, and what was once a piece of beautiful scenery is now a treeless desert.

A Tour through the Woods and Forests of Duff House, Banffshire.

(*Continued from page* 633.)

Resuming our conversation on the subject of pruning, at the foot of the Monk's Hill, under the dark umbrageous shade of a majestic Silver fir, we were much edified with the debate which was conducted by two practical foresters. Very many analogous illustrations were brought to bear on this most important subject, both physiologically and in relation to the production of timber of most value, also, at what season of the year is it best to perform the operation of pruning?

To give this discussion in full would be more than enough for the pages of this Journal; suffice it to say that the ultimate result was—close pruning is injurious to the production of timber of the greatest value. This we can easily believe; in fact, we can substantiate it, for on examining the many trees in our walk over the grounds we regretted very much to see so many large limbs sawn off the numerous trees, and were informed that after felling the same many were almost useless, owing to the fact of the wound not having healed, consequently the duramen or heartwood decayed, thereby forming a receptacle for the lodgment of the rain-water, until from this part a good way downwards it was entirely rotten. Another system was that of "snag pruning," by cutting the branch off about one foot or more from the stem or trunk. This system was considered to have the same effects as close pruning, only it took a few years longer before its effects reached the main stem; yet in the long run its physiological effects were the same, *i.e.* injurious to the growth of the tree, and detrimental to the value of its timber.

The third and last system of pruning was that of foreshortening the branches, by cutting back any long rambling branch to about one-third or two-thirds of its entire length, as the habit and balance of the tree should warrant, always lopping off the same at a joint. By this method the branch continues to grow; the leaves, being the lungs of the plant, are in a measure not destroyed, and its breathing powers not virtually reduced; the appearance of the tree improved, its timber not impaired, but the production of the same increased by more strength or vigour being thrown into the main stem. The seasons of pruning

were then discussed in a similar manner, at the conclusion of which it was decided that the spring was the best time for pruning operations, because immediately on the rise of the sap nature commenced the healing of the wounds, and by autumn the same was so far advanced as to be able to withstand the severity of the following winter, whereas if pruned when nature is dormant the wound is exposed to all the vicissitudes of the weather in a green and tender state, and in a severe winter the skin is liable to open round the wound so made. We were much edified by this interesting discussion, but had reluctantly to bid adieu to the subject, and resume our journey with the object of beholding still further the beauties of nature.

The next object of interest in our perambulations is the home nursery, in which are growing two beautiful specimens of *Araucaria imbricata*—male and female together. These are two splendid specimens, but we regret to see them planted so close to each other, the branches of the one almost touching the trunk of the other, they being little over 10 feet apart. The circumference of the male plant at 1 foot from the ground is 3 feet 6 inches; height 25 feet, with a spread of branches about 18 feet in diameter. The circumference of bole of the female plant at 1 foot from the ground is 3 feet 11 inches, spread of branches 18 feet, with a height of 22 feet. This home nursery is principally employed for the cultivation of trees, which by frequent transplantings can be removed with success in a large state to their permanent places in the policies or in the forest.

Continuing our walk along the carriage drive, we cannot but observe on the one hand a great extent of young plantations, which seem to thrive very well, as some of the young trees have made from two to three feet of growth during the past season. On the other hand we now and again get a lovely glimpse of the winding river through and over the trees. Nothing of special interest occurs for a considerable distance, but the numerous varieties of trees and shrubs of all kinds, until we reach the bridge of Alvah. Here a sight presents itself to our gaze which we are not likely soon to forget, the view being peculiarly wild and romantic. The river is considerably narrowed by the lofty impending crags, over which a majestic arch is thrown. Amid the graceful windings of the river, the rugged scenery on either side, together with the overhanging woods, form indeed a magnificent landscape well worthy the pencil of a Claude Loraine. It is only in wild and romantic Scotland that such scenery can be seen in its fullest grandeur, and only those who have travelled in these deeply embowered caverns and dark umbrageous dells can appreciate Nature in all her majesty, for here we venture to say that sylvan nature reigns supreme. We cannot help thinking that amid these beautiful retreats and shady walks many a lover has composed a charming sonnet to his

lady love. But words are inadequate to express the grand scenery displayed; indeed, it will be easier imagined than described, for here—

> "The mountain ash waves high its wingèd leaves,
> The fringy larches shake their pensile plumes,
> The flowery thorn its timber meshes weaves,
> And quivering birch and woodbine breathe perfumes,
> Anon, far grander traits the scene assumes."

Standing and viewing the scenery as we were, under the glorious influence of the setting sun, and at our back a large forest of Scots pine, what a beautiful pictorial effect! the level rays of the sun striking upon their red barked stems and branches lighting them up like pillars of glowing crimson. What a contrast between such a sight and the deep gloom of their dark blue-green foliage! In looking at a Scots pine growing out of a cleft of the rock, we could do nothing but in rapturous enthusiasm exclaim in the words of an eminent critic, as he said of the same tree, "When its foot is among its own Highland heather, and when it stands freely on its native knoll of dry gravel or thinly covered rock, over which its roots wander far in the wildest reticulation, while its tall, furrowed, often gracefully sweeping red and grey trunk of enormous circumference raises aloft its high umbrageous canopy, then would the greatest sceptic on this point (its picturesqueness) be compelled to prostrate his mind before it with a veneration which perhaps was never before excited by any other tree." As we have already said, the scenery might be easily imagined, but our command of words is inadequate to describe it, further than to assert that such scenery is indeed *truly grand.* We venture to say that never were holidays more enjoyably spent, and we only regret that the time at our disposal would not permit of us visiting the whole of these extensive grounds; however, we beg to thank all for their kindness, and possibly we may at a future period visit the remaining portion of these magnificent and extensive walks and forests of Duff House.

D. S. J.

A New Product from the Pine.—Vanillin exists in the sap of the pine (*Pinus sylvestris*) and of the larch. For the purpose of procuring it the trees are felled during the period when vegetation is most active, and are stripped of their bark. They are then immediately scraped, and the product collected in vessels of tinned iron is immediately heated on the spot to prevent fermentation, filtered, concentrated, and allowed to cool and settle. A substance is thus obtained which resembles powdered sugar, and which is known as coniferin. This is a stable compound, and is sent in barrels to Paris, where the vanillin is extracted. The process of extracting the vanillin is an expensive one, but the product is procured at a less cost than the natural vanilla of commerce can be purchased at.—*Scientific American.*

Timber Resources of Turkey in Europe.

A French writer, M. Bricogné,* has lately been at the pains to collect a large amount of information relative to the forest products of the Ottoman Empire, which is not without interest at the present moment.

Availing himself of the reports of M. Bzrozonski, late chief inspector of forests in the *vilazet* of the Danube, and other presumably reliable sources of information, M. Bricogné shows that the reported wealth of European Turkey in timber—like other reports circulated from time to time respecting that unhappy country—must be regarded with a more than ordinary share of reservation. The natural capabilities of the country in a forestal point of view are undeniable. Its diversity of surface, productive soil, and semi-peninsular position fit it to grow the finest timber in Europe.

Noble forests have been, and in some places still are; but, with few exceptions, the hand of the spoiler is everywhere seen. Ignorance and greed have destroyed Nature's gifts; and where valuable timber yet remains, it is, as a rule, because it is too inaccessible to be worth the trouble of reaching it. Differences exist between the several *vilazets* or provinces, but the remark applies with more or less truth to all.

Bosnia (including Herzegovina) was of yore one vast forest, and though sorely despoiled, still contains some of the finest oak and beechen woods in Turkey. Bosnian oak, mostly the peduncled and sessile-flowered kinds, with a sprinkling of *Q. Ægilops*, is not suited for shipbuilding, but splits well. There is a considerable export from the province, chiefly in oaken staves, deals, and firewood, the latter mostly beech and birch. Most of the stave-wood goes to Marseilles; the deals into Russia. During the six years 1868—1872, thirty millions of oaken staves, averaging 38 in. length, $4\frac{3}{4}$ to 6 in. in breadth, and $\frac{3}{4}$ to $1\frac{1}{2}$ in. in thickness, were thus exported. Large numbers of telegraph poles and railway sleepers are also cut, and over 18,000 tons of wood are annually consumed on the line of railway from Salonica as fuel, wood being found cheaper than imported coal. Bosnia is rich in surface minerals, and amongst other causes of sylvan mischief are mentioned what are known in France as "Catalan forges," a primi-

* *Revue des Eaux et Forêts*, July and August, 1877.

tive mode of iron-smelting, which not only consumes much wood, but occasions frequent forest fires.

Of Albania little is known. It has fine forests of beech and fir, which are very inaccessible, and the export of timber is forbidden on political grounds.

Thessaly and Macedonia in bygone days supplied the dockyards of Salonica, and entire fleets were built of oak thence brought. The demand continues, but the supply has fallen off, and here, as in other parts of the world, the choicer descriptions of naval timber are no longer procurable. These woods still furnish a variety of forest products, from holm-oak charcoal to the tallest masts. Amongst the industrial establishments located there are mentioned a large manufactory of farm implements and numerous saw-mills in the mountains. Forests of conifers clothe the mountain sides, and about Mount Athos are noble forests of oak and chestnut, described a good many years since in that very entertaining work, Curzon's "Visits to the Monasteries of the Levant" (1834), and which are still nearly untouched. They belong to the mountains, and some of them are said to date from the time of Constantine the Great (A.D. 313). Bulgaria, in the Middle Ages a vast forest, of which traces were still visible fifty years ago, now scarcely possesses wood enough to supply the inhabitants with fuel. As an illustration of the rapidity with which the work of destruction has gone on there of late years, the forest of Deli-Orman is mentioned. At the beginning of the present century it covered an area of 2,500 kilometres, and contained some of the finest oak in Europe; now it is reduced to between 30,000 and 40,000 *hectares*, full of clearings and mangled trunks. In Bulgaria, more than anywhere else, the effects of disafforesting are felt in the increased severity of the winters and the increasing frequency of droughts.

The *vilazet* of Adrianople—the ancient Thrace—appears never to have been much wooded; but it was the most populous and best cultivated part of the Byzantine empire. Then and afterwards, so long as agriculture flourished, the timber was respected; when it declined, the woods began to suffer. It is at present irregularly and sparingly wooded, but there are some fine woods of oaks, beeches, pines, and firs. The markets for the timber are along the upper course of the Maritza, in large towns like Adrianople, Tatar-Bazardjik, &c., and in Egypt and the Archipelago.

The *vilazet* of Stamboul at present contains but little timber, although it is said that at the beginning of the century the environs of Constantinople presented a fine growth of forest, which now no longer exists. Everywhere the destroyer has been at work. Even the forest of Belgrade, which encloses the reservoirs for the supply of

the city, has been reduced within the last thirty years from 12,000 hectares to 7,500, one-third of which is clearings.

So far as authentic data are procurable, it appears that Turkey in Europe must still contain *at least* 1,425,000 *hectares* (three and a half million English acres) of forest and woodlands.

The varieties of timber are not numerous, but what there are are valuable. As a rule, the larger flora of European Turkey differs bat little from that of Western Europe, and amongst the numerous shrubs which flourish luxuriantly on low, warm sites, and which include the myrtle, citron, orange, olive, rose, &c., are very few but may be found in similar localities in the South of France.

Forest vegetation exhibits four zones, which now are very imperfectly defined, varying much in their vertical limits in different localities, and even in the same locality with different aspects.

1. The oak (chiefly the peduncled and sessile-flowered varieties) and the chestnut rise, the former to an altitude of 3,200 feet, and the latter to about 2,600 feet.

2. The beeches are found, according to the locality, up to altitudes of 2,000 to 5,000 feet.

3. Resiniferous species—firs, larches, scarlet and Austrian pines, &c., are generally found between 2,600 and 6,200 feet above the sea level. In the Despotodagh—the ancient Rhodope—are still large forests of pines intermixed with firs, crowning the highest summits of Olympus, as probably they did when Euripides applied to it the epithet "many-treed." Here, 6,700 feet above the level of the Ægean Sea, is the highest woodland observed in Turkey in Europe.

4. The evergreen oak, the Judas tree, and a variety of noble arborescent shrubs, mingled with some woods of Aleppo pine, cover (where they have been spared) the low hills bordering the Ægean and part of the Sea of Marmora. On the Black Sea shores peduncled and sessile-flowered oaks are found at all altitudes, coming down nearly to the water's edge. The oak, the tree *par excellence* of the Balkans, within its own vertical limits may be said to be the predominating forest growth everywhere in European Turkey.

Several distinct classes of property are recognised in Turkey in respect of standing timber.

First, there are the woods known as *korous*. These belong to private persons or village communities, both the land and the timber on it being private property.

Next come the State forests properly so called, which have been specially assigned to the use of some particular branch of the public service, as the Navy or the Ordnance. Then there are the *baltaliks*, woods of which a right of usufruct belongs, by ancient custom, to particular villages, the land remaining the property of the State. A

sort of semi-proprietorship exists in the case of these *baltaliks*, as the users have a legal right to prevent strangers cutting wood in them, although they have themselves no right to sell or even to clear the ground.

Intermediate between public and private woods come those known as *vakoufs*, which have been left at some time or other for the use of religious foundations, and the management of which consequently rests with the *evkaff* or administration of mosque property and charitable trusts, which receives their revenue and defrays the cost of management.

Lastly, there are the public forests, which virtually belong to no one, but of which every one makes unrestricted use as though bent on their annihilation at the earliest possible moment.

According to both the letter and the spirit of the old Ottoman law public forests (*djebel mubah*) could only exist where the land was utterly valueless. The remoter parts of mountains, the face of cliffs, inaccessible peaks, and the like, alone were to be thus regarded as a sort of "no man's land," as the Arabic root of the word *djebel*, denoting a rugged mountain side, testifies. But in practice, particularly of late years, it has not been so. Wherever forest land, not being private property, has proved easy of access, or facilities have offered for its destruction, there both land and timber have been treated as *djebel mubah*, and worked accordingly. And it is a significant fact that wherever *djebel mubah* is recognised agriculture declines and disappears, leaving the population dependent for existence on the forests they are doing their best to destroy.

The Forest Department, which figures in the Turkish Budget of 1875-6 for a sum of £161,000 sterling, has proved wholly inadequate to meet this evil. The causes are too deeply seated. The disappearance of the flocks, the folding of which formerly provided for the amendment of the fields, the decline of tillage under the ever-increasing burthen of taxation, the ignorance and obstinacy of the peasantry (in which respects the Christian populations stand conspicuous), not to speak of the squabbles between the *erkoff* and the officials of other departments, and the utter apathy and indifference of the Government, all have contributed to the results.

Private woods, as the *korous*, it should be said, are generally well preserved; and there appears reason to believe that with adequate forest management much valuable timber might yet be saved in various parts of the country, and, with the aid of improved communications, be turned to account.

However this may be, of the present state of the timber resources of Turkey in Europe there can be no doubt. The popular notions of forestry there prevailing may be summed up in the pithy words of a

recent writer, who refers to the climatic changes the country has evidently undergone owing to disafforestment:*—

"The destruction is truly pitiable, and the plains and low hills are for the most part denuded of trees. If wood is wanted for a fire, the nearest trunk is mangled with an axe to provide it; and if there is a ready sale for the wood, down come the trees wholesale, without a thought of the future. The idea of planting trees never enters into the head of Turk, Greek, or Bulgarian. It would be a present outlay for the benefit of posterity, which would appear to every one as the act of a lunatic."

Hedgerow Trees.

THE kinds of trees best fitted for hedgerows are the oak, elm, particularly the narrow-leaved, sycamore, black Italian poplar, chestnut, maple, larch, and Scots fir. In high or exposed situations the hardier sorts should be chosen, such as the sycamore, birch, larch, Scots fir, and I should recommend planting pretty thickly at first, say from 10 to 15 yards asunder, and when grown up, let them be thinned out if necessary. In lower situated grounds from 20 to 30 yards apart is a good distance; in small enclosures, surrounded by larger that are well planted, fewer still are wanted; observing to plant thickest on the east and north sides of the fields, as the winds from these points are generally keenest and most destructive to vegetation. The lands exposed to the sea breeze from any point should be thoroughly protected. The black Italian poplar is an excellent sort for hedgerows, being much quicker of growth than the others, and furnishing a wood now in great repute. A few Scotch firs dotted along the hedgerows among the deciduous trees would have a pleasing effect to the eye, and answer the purpose of shelter equally well with the other kinds. In those districts where coal is scarce the loppings of the hedgerow trees would be a valuable consideration to the tenant as fuel. With regard to the expense of planting, it is so trifling a consideration, compared to the advantages this plan holds forth, that it is not worth taking into account, as two or three men would, in a very short time, plant a large estate, and I am quite sure that many estates, especially in the north, would repay to have much more hedgerow timber than they possess at present.—WILLIAM PEEBLES, *Forester, Corrimony, Inverness.*

* Baker's "Modern Turkey in 1877."

School of Forestry at Evois, in Finland.

By the Rev. J. C. BROWN, LL.D.

(*Continued from page* 551.)

"Section 25.—It belongs to the duties of the director, in council with the teacher and forest master, to make a programme of study, grounded on what is laid down in sections 23 and 24, for each year, as indicative of the duration of the course of instruction, and also a table of lessons containing the teaching hours in the week, with a division for each branch of science and teacher; and this programme before the end of May must be sent in to the forest bureau, which, besides *examining it themselves*, shall submit it to the committee of the Imperial Senate entrusted with superintendence. And it belongs to the director also to watch over the fulfilment of the programme as confirmed, and the course of the table of lessons, and in general to see that the pupils obtain practical acquaintance with their subjects.

"Section 26.—The pupils' progress in the different sciences shall be judged according to the following scale: *very distinguished; with recognised distinction;* and *good;* by which characteristics the pupils' diligence and activity shall be marked in their certificate of dismission.

"Section 27.—Each year, at the end of the spring term, there shall take place a public examination, under the control of the head director in the forest bureau, or in the presence of one appointed by him, of the pupils of the institution; in regard to which examination a month previously an advertisement shall, by the director's care, be inserted in the official gazette of the country; and a special notice of the examination shall be sent in to the director of the agricultural department of the imperial senate. In this examination, which should not extend over three days, questions shall be put to the pupils in all the theoretical and practical subjects of instruction in which they have been instructed during the course of the year, and the pupils ought also to give proof at the same time of their acquaintance with, and their expertness in, the work of a practical forester.

"Section 28.—The pupils in the second or higher class who wish to obtain a certificate of dismission from the institution shall, before the public examination takes place, be subjected to examination by each teacher.

"Section 29.—Immediately after the close of the examination the director and teacher shall come together in the presence of the head director or his deputy for the consideration and determination of the following matters:—1st, what character shall be inscribed on the certificate of each pupil; 2nd, which pupil shall go out of the institution either with a complete diploma as forest conductor, or merely with certificates of study and progress; 3rd, which pupils can be removed from the first to the second class. The determinations come to shall be inscribed in the matriculation register, and publicly read out to the pupils.

"Section 30.—The diploma for the degree of forest conductor shall be written out and subscribed by the director and by both the teachers, and must contain the results given as above of his examinations. To the pupil who wishes to

be dismissed from the institution without having been approved by public examination, the director and both the teachers in common shall give him a certificate, wherein in accordance with the matriculation register shall be set down in full what knowledge he brought with him at his entrance into the institution, the time he has availed himself of the instruction of the institution and the degree of proficiency he has shown in each branch, as well as his diligence and his ability.

"Section 31.—If the pupil is compelled from any other cause to leave the institution before the course is completed, or the yearly examination has taken place, and should wish to receive a testimonial from the institute, such shall not be refused, but it shall be drawn out in the above-mentioned way, with special reference to the occasion of the pupil's leaving the institute.

"Chapter V.—The Discipline. Section 31.—It is hereby laid down, in accordance with section 5, that the management of the institution belongs principally to the director; it belongs also to the teacher to support the director in this, but particularly in his control over the pupils.

"Section 32.—When weightier questions arise the teachers may be called together in council at the instance of the director as president, in order to examine and decide the plans laid before them by the director; the determination in this case shall be in accordance with the voice of the majority.

"Section 33.—The pupils are bound to show respect and obedience to the director and teacher; to conduct themselves courteously, and to show a respectable moral character; to appear punctually at the lessons; to listen with attention and diligence to the instruction; to perform the exercises which are prescribed, and to conform carefully to the various prescriptions and arrangements of the institution. Without the director's permission no pupil may leave the institution.

"Section 34.—With respect to breaches of discipline on the part of the pupils the following punishments are prescribed:—1st, a simple reprimand from the director; 2nd, summons before the college of teachers; 3rd, rustication from the institution for a half-year; 4th, expulsion. The first and second punishments may be determined by the director, removal for a short time, or expulsion, must come before the college of teachers, who in each special case are bound to place the matter before the forest bureau, and await their decision; if the punishment be expulsion, this shall in the case of a pupil under age be communicated to his guardian through an extract from the minutes. Punishments three and four are to be mentioned in the register of matriculation.

"The service of the institute shall be under the direction of the steward, of the director, &c., &c.

* * * * * * *

"Chapter VI.—The institute's buildings, furniture, instruments, and other helps for instruction.

"Section 35.—The buildings, the fire-engine, and the instruments of the institution should be carefully repaired and preserved; and the director is bound, twice a year, in May and October, in company with the teacher and a good carpenter and mason, to examine the whole buildings and fireplaces, on which occasion all damages are to be noted, and estimates made for their repair. In case greater repairs are wanted, the director must send without delay the documents containing the examination and estimate to the forest bureau, in order to be by it handed over to the head bureau for public buildings, so that the said bureau may take proper action in regard to the matter.

"If the damages are of a less important character, but which do not lie with the person who lives in the house to repair, the director can then see if the repairs cannot be made through an advance from the means supplied for the extraordinary expenses of the institute. Nevertheless the director shall every half-year report such extraordinary expenses to the forest bureau, with a view to sums thus advanced being properly met. It is the duty of the teacher to make with respect to all such buildings, inventories, which shall be sent in every fifth year, at the end of February, to the forest bureau.

"At other times a supplementary account has to be sent in yearly, at the same time of the year.

"Section 36.—The collections and property of the institute must be accurately valued and recorded. These are:—

"1st—Forest instruments and tools, and botanical, forest, technological, chemical, and mineralogical collections of the director.

"2nd—Models of buildings, physical and zoological collections of the forest master, together with

"3rd—Instruments for geodesy; and these, together with the inventories, are to be kept in the archives of the teacher.

"Section 37.—The director ought, after taking counsel with the teacher, to buy such books, treatises, and plates for the library of the institute as will serve to the completion of the instruction.

"It rests on the director to determine when the library is to be opened for the loan of books.

"Chapter VII.—The management of the moneys of the institution, and the accounting of the same.

"Section 38.—All dues and other revenues which accrue to the institute shall be received and accounted for by the teacher, and he may not defray other expenses from these means than those which have been approved by the director. These the teacher shall defray according to the determination of the forest bureau.

"Section 39.—The teacher shall keep a proper cash-book, which shall be balanced every month, after due audit by the director, and comparison of the balance with the cash in hand. An extract from the cash-book shall be handed over every month to the director, who must hand the same to the forest bureau before the 8th of the following month.

"At the close of the year a complete account shall be made up by the teacher of the means under his management; which account, after proper audit, shall be handed in to the forest bureau; and after the account has been examined and checked by the forest bureau, it shall be handed in to the proper department of the Imperial Senate.

"Section 40.—In case of the resignation or death of the teacher, it shall belong to the director to keep the cash account, and superintend the book-keeping and the other official duties and effects of the institute. Should there be any deficiency in the cash, or other defect, it is the duty of the director, as part of his responsibility, to lay this as soon as possible before the forest bureau, together with an account of what is missing; and it belongs to the forest bureau on occasion of the same to take the proper steps to preserve the rights of the Crown.

"To whomsoever the above concerns, Helsingfors, 2nd May, 1874, in His Imperial Majesty's name. Sd. K. Furnhielm, Th. Thilen, H. Molander, Oscar Norrmen, A. Mechelin.

"F. Walmquist."

"Payments in the Evois Forest Institute, as laid down by His Imperial Majesty:—

	Finnish Marks.
Director's salary	3,600
Board wages	1,600
Allowance for horse	400
	——5,600
Teacher's salary	2,000
Board wages	1,000
Allowance for copying	200
	——3,200
Forest master's wages in Evois and Wesijako Crown parks, for assistance in the instruction of the institute	1,000
Allowance for a boy and two firemen, estimated at ...	1,200
Light, writing materials, books, newspapers, furniture, and inventories, estimated at	1,000
Cutting of wood	1,200
Support of buildings	1,500
Total	14,700

"*Remark.*—The director, teacher, and forest master, together with the servants of the institute, have free lodging and the right to graze—the first three two cows each, and the last one cow each. Besides this, the director, teacher, and forest master shall have the use of a *tunneland* in the neighbourhood of the institute, and the servants a mark for potato ground. If any of these persons wish further to rent property appropriated to the institute, they will obtain the same by applying to the Imperial Senate, and paying money into the cash of the institution."

No one of my correspondents on the Continent has manifested a more lively interest in the plea which has been urged for the creation of a School of Forestry in connection with the Arboretum in Edinburgh than has Professor Blomqvist, Director of the Forest Institute at Evois. In one letter he wrote,—

"The day before yesterday I had the pleasure to receive by post your little volume entitled 'The Schools of Forestry in Europe.' I have perused it with much interest, and I feel convinced that you have hit the nail on the head. It is beyond all doubt of the greatest importance for forests throughout the world that your suggestion of the creation of a School of Forestry in connection with the Arboretum in Edinburgh, or some similar scheme, should be realized, and on my part I wish you complete success. The matter is, moreover, of such manifest necessity, that sooner or later some such measure must be carried into effect. So soon as this shall be the case I hope to be informed of it. Meanwhile I wish you health and strength for the energetic efforts which may be required to bring the seedling to maturity."

In another letter he wrote still more strongly of the world-wide benefit to be expected from the study of Forest Science in all its

comprehensiveness being taken up by the Anglo-Saxons of England, America, and the British Colonies.

And in reply to inquiries which I addressed to him he wrote to me as follows, errors of translation, &c. (if any), excepted.

"Our institution at Evois is by much too limited and inconsiderable to be taken as a pattern for any other place. It was reorganized in 1874, so as to cost as little as possible. The number of teachers was then reduced. But this I look upon as a mere temporary arrangement, and therefore I may state at the outset that it is the original organization adopted in 1860, when the institution was founded, upon which I base the following statement.

"At that time there was a director, who was also a teacher, and three other teachers,—one for forest science, one for natural history and chemistry, and one for mathematics; a *forst-meister*, or forester, who also was a teacher, and a drawing-master, who was also secretary and librarian—in all six teachers.

"The subjects on which instruction was given at that time were then, as now—

"I. Forest sciences: *Wald bau* [sylviculture], *Forst-taxation* [forest management, and regulation of the quantity of forest produce to be obtained], *Forst technicologie* [technical properties of different kinds of wood, practical felling of trees, treatment of the timber mechanically and chemically, transport of the same by land and water, &c., &c.], *National ekonomie* [political economy], with a special view to the treatment of forests so as to promote the prosperity of the community, *Forst liche Rechts kunde* [the existing laws and regulations relative to forests, game, and fishing, the rights of property, &c.].

"II. Physical science: forest botany, forest zoology, and elements of mineralogy and of geology.

"III. Geodæsia, or land surveying, mainly practised by exercises in measurements in forests throughout the summer.

"IV. Rural economy: general instructions in all matters relating to agriculture, &c.

"V. Civil engineering: principally road-making, and construction of pontoons and floating bridges.

"VI. Forest mathematics, or the application of mathematical principles to forest economy.

"VII. Park-keeping and scientific administration of forests.

"VIII. Drawing of maps, charts, and plans, and practical exercises, &c., in all forest work, and everything also relating to the management of State forests

"These are all still the subjects of study; and previously to entering the institution every student must have passed the entrance examination at the University of Helsingfors, and therefore must have become acquainted with the first elements of the various branches of physical science, so that all the studies here are now directed towards the practical and professional application to forestry of what has been attained previously and otherwise.

"From the 15th of June to the 1st of November nearly the whole time is spent by the students in practical work in the forests, principally in measuring forests, preparing charts, and in works of *taxation*, as explained above.

"During the months of winter lectures are delivered, as in the university, and thus are occupied at least twenty-one hours a week. A special law enjoins that the students shall be well instructed in the preparation of charts, and that they shall be kept fully employed.

"Formerly, besides the instruction which has been specified, and which is still given, systematic instruction was given to a greater extent than now in general botany, and in general zoology, in mineralogy and geology, and in chemistry, mechanics, and natural philosophy.

"The last-mentioned subjects are now given up, and the others are treated only cursorily.

"The course of study now, as formerly, extends over two years. The existing organization is defective, and at least two additional teachers are required. At present there is only the director, who gives instruction in forest science, political economy, and forest law, which appointment I hold; a teacher of land surveying and rural economy, and of book-keeping during the winter months; a forester (*forst-meister*), who is at the same time teacher of forest mathematics and of civil engineering.

"Besides these we have only a lecturer on natural history and one assistant forester—in all five men, four teachers and one assistant.

"Since the 1st of November last (1876) there has been opened also a school for twelve peasant pupils to be trained as forest warders, who are trained principally in the practical work of forest workmen; but during the winter they spend nineteen hours a week in theoretical studies.

"One consequence is that we all, and especially I, are so much occupied that little even of our spare time can be devoted to literary work. A work of some importance, upon which I have spent the labour of some years, lies by me unfinished for lack of leisure to complete it. But we hope for a good time coming.

According to my view the study of forest science should be prosecuted at the university. At the Convention of Students of Forest Science and of Forest Officials held two years ago at Frieburg, there was passed unanimously an expression of opinion that a university was the proper place for the study of this science by intending foresters. Forest science is quite as much a science as is medical science, or the science of engineering,or the science of mining, and that of agriculture and agricultural chemistry.

"In my opinion Edinburgh would be a specially appropriate site for a school of forestry, seeing that in Scotland there are so many well-kept woods. In the vicinity of the city, or at no great distance, might be found woods for field instruction, or one might be created for the purpose. In a university there should be two different chairs of forest science, as without a protracted course of study it would be difficult for one teacher to do justice to the various branches of it. For the forester to be acquainted with both forest science and political economy is not less necessary than to be acquainted with botany. A surgeon cannot do without a knowledge of anatomy and of physiology; as little can an educated forester do without a knowledge of the anatomy and physiology of vegetables. Forest science must in a special degree be based on botany; and the day is coming when botanical science shall be so developed that a professional botanist who has not studied forest science will be deemed incapable of instructing others in botany.

"My view accordingly is that either the teacher of botany should be acquainted with forest science, or that the teacher of forest science must be also a forest botanist.

"Next in importance to botany I reckon mineralogy, in its relation to geology and the knowledge of soils, as a science which should be taught in a school of forestry. Without this the forester can have no insight into the means whereby trees find nutriment, and into the relation in which the soil stands to this operation.

"There is no doubt that great advantages may be obtained from locating a school of forestry in a university town, either in connection with the university or independent thereof. Associated teachers of other subjects and museums of instructive objects can then be utilized. But if a school of forestry be so located it is of importance that the students of forestry should not dissipate their energy by giving attention to too many different subjects. I would limit them to say *five*, and leave the student to make his choice on what five subjects he shall be examined. These might be—1. Compulsory or necessary subjects: Forest science, political economy, law, *botany, mineralogy and geology, land surveying, forest mathematics, forest zoology.* 2. Optional subjects: Chemistry or natural philosophy,—the five sciences given in italics being indispensable; but only in one of these would I demand excellence: in the others I would be satisfied with the verdict 'satisfactory.' '*Non multa sed multum*' is an important principle."

These views by Professor Blomqvist are well deserving of consideration. Meanwhile the whole shows what importance is attached by men well qualified to judge of what is required for the proper management of forests, in the education and instruction of men entrusted with this work.

Influence of Trees on Rainfall.—There can be little doubt that there is a distinct connection between the rainfall and mean temperature of a country and the number of trees the latter may possess. Trees are magnificent regulators of climature. They are to it what the pair of revolving "governor-balls" are to a stationary engine. When the engine is going too fast, the "governor-balls" distend, and "throttle" or compress the aperture whence the motive steam-power is issuing. When the engine is working slowly, the balls droop, and so open the valve as to allow more steam to issue. The same with the woods and forests of a country. When the rainy seasons are on, every tree and plant absorbs some of the moisture, and stores it away in its own tissues. It thus prevents great quantities from flowing off the surface, and gathering into rills and rivulets, and so swelling the main rivers as to cause them to overflow their lowest lying banks. During periods of drought the leaves of the same forest give out the moisture they consumed into the atmosphere, and so prevent its being as dry and parching as it otherwise would have been. During the hours of night, also, the surfaces of the leaves become colder than the air, and thus the moisture contained in the latter is condensed upon them as dews. In many parts of Arabia this is the only kind of waterfall with which the parched earth is visited. The destruction of woods and forests, therefore, is always attended by an alteration of climate for the worse. It becomes more irregular. There are now alternate periods of rainfall and consequent floods, and of droughts. No country in the world has been so altered in this respect as the United States, for in no other has there been so much clearing of forest land within the last two centuries. In Italy great destruction of forests has taken place, and the summers are now more arid and hot in consequence. The reader will find in the Hon. G. Marsh's "Physical Geography as influenced by Human Action," a long list of parallel cases, where men have unconsciously modified the climate of the country in which they dwelt.—"*Watery Wastes,*" *by Dr. Taylor, F.G.S., &c.*

Windsor Forest and Park.

Until its enclosure in 1817 Windsor Forest was an open common on which the Crown and several subjects enjoyed mutual rights. The period when the park was fenced off from the common ground has not been ascertained. Norden's map of 1607 shows the boundaries, and Sir William Cecil was petitioned in 1568 to allow two French glassmakers the privilege of cutting wood and burning charcoal in Windsor Great Park. About the same date an anxious Parliament took measures for increasing the supply of shipbuilding timber, and enacted that at the periodic cutting of the Windsor copses twelve "standils or stores" per acre should be left to form a future wood. It is probable that the fencing of the park from the forest occurred long before the reign of Queen Elizabeth. Records relating to this domain earlier than the time of Charles I. do not exist, as the whole of those most interesting documents were destroyed during the Civil War by the parliamentary soldiers, who held the castle throughout the struggle, and found the papers useful material for lighting their fire. Prince Rupert used his utmost efforts to dislodge the destructionists, but without success. In the next reign he became a keeper of one of the forest walks, and thirty other old soldiers occupied the Great Park, which they farmed on the five-verst system, the marks of their furrows being still visible.

According to a survey of 1661, the king enjoyed a right to twelve loads of hay, "to be taken yearly from the meadow called Runnymede," for the feeding of the deer. The principal forest walks were Cranbourne, New Lodge, and Bagshot. Lord Mordaunt was the Head Keeper and Constable of the castle; the arable land was let to the old soldiers at £200 a year. It was a good time for timber, inasmuch as John Evelyn, a zealous royalist, had recently delivered his "Discourses on Forest Trees" before the Royal Society, and improvements were afoot. Fences were now formed round the cultivated fields at Windsor, hedgerow elms were planted, plantations filled up, and grass seeds sown. Between the years 1670 and 1680 Evelyn was a frequent guest at Windsor Castle, and the king was constantly engaged planting rows of elms on the French plan, which had been previously borrowed for the adornment of Sayes Court. Before the time of Evelyn the country must have been very poorly ornamented with timber. The magnificent forests of "nature's" planting had been

sadly diminished and cut up; the hedgerow trees were horribly mangled and trimmed up for firewood, the elm being the favourite, in consequence of its large production of successive crops of boughs, and its patience under repeated mutilation. It was employed for the great avenue of the Long Walk on the south approach to the Castle. The couplet—

> "Here aged trees cathedral walks compose,
> And mount the hill in venerable rows,"

applies to the present appearance of the avenue, which Pope saw only in its infancy. The planting of the Long Walk was commenced in 1680, on the purchase of the fields lying between the Castle and the Great Park. The distance from the Castle to the statue of George III. on Snow Hill is two and three-quarter miles, and the length of the avenue is rather less. The distance between the two inner rows is 150 feet. The trees are ten yards apart in the rows, and each tree composing the aisles at the sides is thirty feet from its neighbour, which is considerably less than it should have been. There were originally 1,652 trees. Those on the low ground, and on good loamy land, ten or fifteen feet deep, on chalk, at the Castle end of the avenue, are twice as large as those on the cold stiff clay on the ascent towards the statue, and at this southern end there have been some failures and replanting. Mr. Menzies, the resident deputy surveyor, mentions in his "History of Windsor Great Park and Windsor Forest" that red tape has been amply manifested in their unprosperous condition. All the oldest planted woods are of about the same date as the Long Walk.

In the plantation of oaks between Bishop's Gate and the road running from the top of the Long Walk to Blackness there are thirty-two trees to the acre, containing on an average 104 feet each of timber. They are sound, healthy, and growing fast, the soil being a fine light loam at top and a good clay below, and the land at planting was trenched. There is a photograph of one of these oaks in Mr. Menzies' magnificent work. The height is 100 feet, the circumference of the trunk is nine feet at five feet from the ground. The tree will be found standing at the edge of the wood close to the Royal Chapel. The planting of the pleasure-grounds of the wilderness (now Cumberland Lodge) belong chiefly to the period between 1695 and 1735.

In 1711 Dean Swift visited Windsor, and wrote to Stella how much the Long Walk surprised him. The Duchess of Marlborough was then the Ranger, and so continued till her death in 1744, setting the Court at defiance in a very termagant fashion. Among her numerous complaints she declares she is out of pocket, keeping up the lodges and paying the keepers, and "all she got was a few Welsh knuts to eat and the grazing of some cows." At the age of eighty-four she is still busy about the park, and often "in the vapours against

knaves and fools, both of which," she says, " I hate." She complains, too, that the Duke of St Albans, the Constable of the Castle, " besieged her in both parks," and broke open a door at Cranborne Lodge without her leave, for which offence she forbade his driving through the Park. " I have forbid it," she writes to the Duke of Newcastle. " He urges a necessity for it on account of his supervising the fortifications—a term in my mind extremely odd and ridiculous. If he means by it the ditch that is inside the castle, I am so far from desiring to prevent the constable from doing his duty in his military capacity, and putting the place in a proper condition of defence, that "—and here she contemptuously promises that her keepers, or " any other engineers," shall attend him when he pleases; but she sees " no immediate probability of an attack."

Windsor Forest has inspired several poets, and among them Pope sang here as a boy, though his juvenile " Windsor Forest " is not a definite description of any forest in particular. As in other forests, most of the old trees are pollards or " dottards," produced by the custom of lopping for firewood, or to feed the deer. The largest of the old pollards is about 27 feet round the stem. Maiden oaks, however, grew up under the protection of thorns and bushes, which were the nurses of trees growing upon common land, protecting them in infancy from the devastations of the cotters. Many of the " commoners " of Windsor Forest, by the way, acquired their titles by night. Any idle " loafer," aspiring to become a " commoner," found his opportunity on a moonlight Christmas Eve, when the forest officers were engaged in the annual ceremony of tapping their elder wine.

The encroachment was effected by erecting a hut of turf, and enclosing a quarter of an acre of garden ground with a bank and ditch. In the morning the astonished officers would arrive upon the scene of trespass, after their carouse ; but by that time a fire would have been lighted, and one more " loafer's " pot boiled in that " castle " which the winds of heaven might enter, but which the forest officers dared not.

A short time since the Crown purchased a cottage and garden near the park, and on inquiring for the title the following was the reply of the owner :—" You see, sir, my wife's father as was, so I have been told, lived in another house near this about seventy or eighty years agone, and there was a piece of waste land, as was part o' the common that was handy, and so he first plants taturs on it, and then he got some bricks and some sods, and he put up a bit of a place to take shelter in, and at last he got to live in it, and there was a deal o' bother made about it one way and the other; but he was a servant to a gentleman as was a magistrate in the neighbourhood, and he was friendly to the poor people, and said

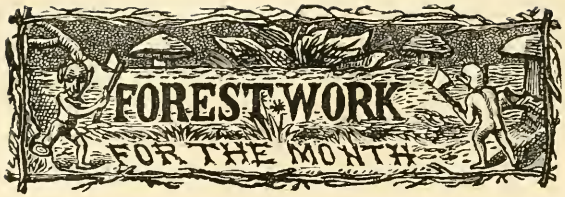
the land was of no use to nobody, and so he kep' it, and when I married his daughter I came to live in it."

Silvanus Taylor, in his "Common Good," dedicated to Parliament in 1652, when a sixth of the land was in common, gives the occupiers of this kind of holding the very bad character which they no doubt deserved. He advises division and allotment, adding quaintly, "Not that the commoners would work men on their own allotments, for while the parish has to maintain them they will not work." The allotments to the Crown on the enclosure of Windsor Forest enabled good old George III. to enjoy the luxury of farming his own land; and upon the same ground the Prince Consort afterwards established the famous model farms which were noticed in the Windsor supplement of the *Gardener's Chronicle*, October 31, 1874, and described in Mr. J. C. Morton's "Report on the Royal Farms," *Agricultural Gazette*, 1862.

Between 1815 and 1822 roads were formed, and a portion of the Crown allotments planted with oak on the heavy, and fir on the light land, including 1,400 acres between Windsor and Ascot racecourse, and 4,000 acres beyond the heath. The demolition of cottages, according to the false exclusive taste of the time, thrust all labourers to a distance from the Castle, and, accordingly, they walked daily a distance of from two miles to five miles to their work, till on her Majesty's accession and marriage the Prince Consort, as Ranger, devoted himself earnestly to this as well as other matters connected with the improvement of the Crown property. At this time four farm homesteads were erected, 2,000 acres of stiff clay land were drained, a large school for workmen's children was erected, and has since been supported by the Queen; herds of shorthorns, Herefords, and Devons were established, and, among the other great improvements, Charles the Second's idea of joining park and castle was carried out. H. E.

SALE OF WOOD IN ROXBURGHSHIRE.

At a public roup of wood, which took place at Pinnacle Hill, near Kelso, on 29th December, 1877, the following prices were realized, most of the trees being of large size and good quality; but some of them, the larch especially, being in very inaccessible places, detracted somewhat from their value. On the whole the sale proved very satisfactory, considering the difficult nature of the ground for removing the timber. Oak trees containing from 40 ft. to 70 ft. cubic, brought from 1s. 5d. to 2s. 3d. per cubic foot. Large old ash sold at from 1s. 4d. to 1s. 9d., and young ash of fine quality at 2s. to 2s. 4d per cubic foot. Fine, clean, large larch trees, containing 30 to 60 cubic feet each, realized 1s. to 1s. 6d.; but they would have brought much more if they had been near good roads.



ENGLAND.

The open weather of the past month has afforded excellent opportunities for falling underwood, and even for the continuance of planting operations, which should now be in a very forward state; and though we have had but little frosty weather to facilitate the removal of heavy timber, yet the general soundness of the land contrasts favourably with the corresponding period of last year.

Nursery work, also, is well in hand, and such seeds as will not keep may now be committed to the ground. The seeds of the oak horse-chestnut, Spanish chestnut, and walnut may be planted early in the month, in rows about 16 inches apart, with about 3 inches between the seeds, and 3 inches deep. At such distances they may remain till finally planted out, though, as many of the plants require undercutting to promote fibre growth, it is better in most cases to transplant seedlings. Where the seeds are in danger from mice and rats some sprigs of furze may be worked into the rows and laid upon the beds.

The crowding of the ordinary nurseryman should be avoided, and ample space afforded to young stock, if sturdy plants are to be produced. Transplanted seedling hard woods may be placed in rows from 20 to 24 inches apart, at intervals of 4 or 5 inches; birch somewhat closer; larch, 15 inches by 3; and Scotch pine, 18 inches by 3. It is probably better to begin with the transplanting of two years' seedlings, and afterwards follow up with those of one year.

Where the land has been previously under nursery stock, a green crop may be taken, and a compost of chalk rubbish, fresh earth and lime, road scrapings, or decayed leaves, worked in according to the requirements of the soil.

Considering the great advantages of burnt soil, it does not generally occupy that position in nursery work to which its valuable properties entitle it. Clays which contain a large proportion of the alkalies and calcareous matter are especially adapted for burning, as by this process their mineral substances become more soluble, and are

consequently supplied to plants in larger quantities. By a free use of such ashes the whole soil is rendered more friable, and the crop is largely increased. The burnt earth keeps the soil open, favouring the admission of air and the percolation of water; consequently roots pass into it more readily, and as the mass is reduced to its saline constituents, immediate benefit to the young plants is the result. Its powers of absorbing ammonia are also greatly increased. While the mass is burning the air should be carefully excluded, and the combustion should be stopped as soon as the clay is blackened. Red residuum is generally overburnt and useless to vegetation.

Powdered charcoal and wood ashes may also be advantageously used in the nursery, as they greatly favour the sprouting of seed. Raw and fermenting manures should be avoided, as they are productive of canker in the roots.

Prepare nursery beds for the sowing of small seeds in March, and look well to the keeping of the seeds.

If the month prove a dry one there will be great advantage in hoeing among the nursery lines, particularly beds of ash.

Where the site for planting out in the woodlands is tolerably free from brambles and other rubbish, there is little gain by keeping the plants too long in the nursery. In ordinary cases the sycamore, maple, sweet chestnut, horse-chestnut, pinaster, larch, birch, ash, and alder may go out at the end of the third year; the oak, hawthorn, spruce, beech, and walnut at the end of the fourth; while holly and silver fir may remain for five years.

In order to ascertain the quantity of bark to be stripped during the coming spring, it will be well to mark the timber early, and take note of the number of trees and probable yield.

February is the most favourable month for cutting the willow, whether for the use of the basket-maker or cooper.

The laying or plashing of plantation hedges should be proceeded with as soon as the wood is off the stub. The smaller the amount of dead wood laid in them the better for their future growth. A thin open hedge of live layers will soon thicken sufficiently. Where the hawthorn does not flourish upon light sandy soils, fill up gaps with beech. Those plants raised from seed put in the ground in March, undercut the following spring, transplanted the next, and allowed to remain two years in the lines, will generally be strong enough for this purpose.

February is a good time for pruning young lime trees, as these make an early start. If the weather proves open the seeds of maple may be planted.

The falling of all hard woods except the oak should be finished during the month.

Where not reared at home, nursery seedlings should now be ordered, to be ready for bedding out.

Pluckley, Kent. A. J. BURROWS.

SCOTLAND.

During the last month we experienced the extremes of both good and bad weather. The first fortnight was unusually mild and genial, so much so indeed that the birds were thrown quite out of their reckoning, and on several mornings were heard singing with great glee. On the 20th, however, a sudden change took place, by a bitter cold wind setting in from the west, accompanied by showers of sleet and snow. During the evenings of the 20th and 21st the wind rose to a perfect gale, causing great damage amongst forest trees. From some quarters we hear that many large trees were blown across the public roads, causing a dead block to all traffic for a considerable time. Wherever trees have been blown over, in parks or policies, all other work should be suspended until they are dissected and carted off, there being nothing more unsightly in a policy than fallen trees lying about with upturned roots. An effectual method of disposing of the upturned roots of trees is to dig a large pit close behind them, if the soil is favourable, into which they fall when sawn from the trunk. These pits should be made deep enough so as to allow at least a foot of soil to cover the highest part of the root. In other cases, however, it is cheaper to blow them in pieces with gunpowder or other explosives, and cart them off to the waste-heap. On those estates where deer are kept the branches of the trees should be carted into the park and scattered about; deer eat the bark of almost every tree with the greatest avidity, and as pasture is very scant just now, a dozen cartloads or so of brush no doubt will be very acceptable to them. Great care must be taken to keep out all branches of yew, as the leaves and bark of that tree are highly poisonous. A sharp look-out must still be kept on exposed trees liable to be attacked by vermin; a man should go round these once a day, and apply a preventive mixture wherever the slightest indication of barking is seen.

The felling of timber may still be carried on, and advantage should be taken of frosty weather to get the wood either lotted for sale or else dragged to convenient stations for carting.

The repairing of wooden fences should also be attended to. This work can be carried on with greater freedom now that the fields for the most part are clear of stock.

Hurdles and other guards round park trees should also be gone over and repaired, care being taken to keep them both high enough and wide enough in order to secure the safety of the trees, more especially in fields where young horses are grazed. A good tree guard or hurdle, fitting close to the tree, may be made from five feet uprights, held together by two bands of hoop iron; the hoop being well adapted for folding round the inequalities of both root and stem. These hurdles, when correctly made, look well, and last for many years.

Plantation and other drains should be carefully inspected, and every effort made to enable them to carry off the superabundant water that is sure to attend the melting of the snow now lying on the ground. We have only to remember that between ground that is waterlogged and ground properly drained there is at least a difference of ten degrees of heat in favour of the latter. This being so, there can be no doubt that the roots of trees are most unfavourably situated if allowed to remain in a soil soured and chilled by stagnant water, more especially when the spring months are so near. This is only one of many other advantages gained by draining, and we trust its importance will be duly considered by every forester.

Planting should be carried on and finished with all despatch, especially upon dry ground, before the parching east winds of March set in. Unless newly-planted trees are well settled in the ground before the arrival of the bleak, drying days we usually experience in early spring, they are liable to suffer severely from the cold blast, and often receive such a serious check to their vitality as to retard their growth for some years, if they do not eventually die off altogether.

In the home nursery, all young stock not required for planting out this season, and which have been two years transplanted, should be carefully gone over, thinned out where necessary, and all receive a good loosening or half raising with a fork, so as to check the over-luxuriance of the trees, and cause them to root freely.

The young trees form small fibrous roots much more readily in the loose soil, and the operation is an excellent preparation for the removal of the trees in the autumn, when the planting season comes round again.

If the ground is in good tilth, and the weather open and dry towards the middle of the month, the opportunity should be taken to complete the sowing of acorns, beech, hazel, and chestnuts, if not already sown; and this is also the best time to sow all such tree seeds as elm, sycamore, alder, ash, birch, &c.

Dalkeith Park. ROBERT BAXTER.

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IRELAND.

We presume those following the instruction given under the above heading will have planting operations far advanced, if not completed. Very damp ground, or ground infested with vermin, may still be operated on, but on principle all planting should now be finished without delay. Larch plants should be immediately attended to; if lying long in the sheugh they will soon show symptoms of growing. It is now too late to plant thorn hedges in the south, but it may be done up to the middle of the month in the north and round the sea-board. Those planting thorn and beech mixed should bear in mind that the beech will not do to be cut back like the thorn.

Make up and repair ditches, on the top of which, in fine pulverized earth, sow prepared haw and holly berries, covering the seed about two inches.

Those who still adhere to spring pruning must avoid such trees as bleed profusely. All pruning ought to be finished during the first fortnight; we are decidedly opposed to spring pruning on principle, although we admit it in practice. Finish planting in the nursery this month, and sow ash, holly, chestnut, acorns, haws, hornbeam, and all stone seeds. Sow in drills. Cuttings, if previously prepared, may still be planted.

Fork flower beds and shrubbery borders in the pleasure-grounds. Peg down branches of rhododendrons, and lay evergreens. Lay turf, repair lawns, pare edgings, gravel and roll walks.

On the farm gather stones on meadow fields, and cart them as material for repairing roads. The roads should never be neglected at this season of the year, when there is so much carting of manure out to the fields. During hard frosty weather stub up furze and briars, where such encroach on the arable land.

An ample supply of firewood ought to be felled. Sales of fencing material and fuel should be held before the 20th, as farm work will then begin, and farmers will scarcely attend from that onwards through the spring.

Ballinacourte, Tipperary. D. Sym Scott, *Forester.*

WALES.

The extreme mildness of the past month will have given foresters an opportunity of forwarding planting operations, which may have got behind at the end of the year. The planting of deciduous trees should, if possible, be brought to a close this month, and only in cases where it cannot be avoided should any plants be left unplanted after the above date. Where the ground has been timely and duly pre-

pared, only an excess of work can furnish a sufficient reason for planting not being finished before the cutting winds of March come upon us. To put off planting till late in spring, with no other reason than waiting for the proper season, is in no way to be recommended. On the other hand, it is advisable for all parties who intend to plant this season, that they should at once proceed with the work during favourable weather, and have it finished up during the present month.

The thinning of hardwood plantations (oak excepted) should as far as possible be finished this month, before the buds begin to expand after which they are apt to get damaged and disbudded by the falling of the thinnings. Trees are also less liable to suffer from being exposed to cold winds, &c., when relieved before they show signs of growth, except when left for operating upon during the summer months. Dispose of all thinnings, and have them removed from the plantation as soon as practicable, as recommended last month. Where fagots and other oven or firewood are required for home consumption, they should be bound up and stacked without delay; if allowed to remain lying in the woods during summer they get entangled with herbage, briars, &c., and are difficult to remove.

Breast and cut over hedges, and fill up gaps in old ones by planting young thorns. Hedges are generally delayed planting until spring, or when all forest and other planting has been finished.

If the bed for receiving the plants has been trenched during the winter or autumn, it is preferable to planting the young hedge in newly trenched ground, and in such a case it is well to plant at once. In bleak and exposed situations we always cut over the thorn plants previously to planting them.

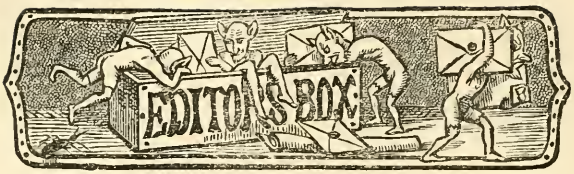
Keep drains clear and in good working order. It will be necessary to overhaul them in newly thinned plantations.

Remove and transplant young stock in the nursery. In removing young oaks it may be necessary to root-prune them, but it should be done with great caution and not too severely.

Kinmel Park. LEWIS BAYNE.

IRON FENCING.

Messrs. G. B. Smith and Co., of 61, West Regent Street, Glasgow, have just issued a new illustrated catalogue of their iron fences, gates, &c Many first-class fences are shown, amongst which is the premium continuous wrought-iron fencing, with improved wedge or staple fastening, which is both well known and highly appreciated. The corrimony galvanized wire fencing is another good fence, which has been largely used. Gentlemen about to erect fencing should send for a copy of this catalogue.



[*Correspondents sending letters signed with initials or fictitious names are requested to enclose their name and address, as otherwise their communications cannot be inserted.*]

PARIS EXHIBITION.

Sir,—Having undertaken to write a report on the present state of Forestry in Scotland, under the auspices of the Highland and Agricultural Society, for the Commissioners of the International Exhibition to be held at Paris this year, I will be very much obliged if any of your readers in the north (especially practical foresters) will kindly send to my address, at their earliest possible convenience, any information regarding the woods in their respective localities, or under their own charge; detailing the extent of the acreage under wood, the age and varieties of trees generally, their average height or size, the altitude of the situation, nature of soil, &c.

Any observations as to management, or other information they may choose to communicate to me, will be very acceptable.

I am, sir, yours faithfully,

Robt. Hutchison.

29, *Chester Street, Edinburgh,*
24th January, 1878.

[We strongly recommend the above to the favourable notice of our readers in Scotland. It is only through the kind interest of proprietors, and the active assistance of intelligent foresters, that the necessary information can be obtained; and we hope that our Scotch friends will show their usual intelligence and alacrity in promptly supplying Mr. Hutchison with the desired information, so that a full and complete report of the present state of Scotch Forestry may be drawn up for this important occasion.—*Ed.*]

ESTATES MANAGEMENT.

Sir,—I am pleased to find your correspondent "A. B." has broached this subject in your last issue, and that it has met with a hearty endorsement from you. Those in charge of estates have, or are supposed to have, clear and comprehensive views of farming in all its branches; keeping pace by reading, observation, and practice with the ever progressive state

of agriculture, thereby enabling them to encourage the system best calculated for the soil, climate, and the many peculiar circumstances of an estate, not merely looking at things in a purely commercial sense, but always having present to their minds contingencies, remote or otherwise, that may arise, and in some way affect the property under their care.

The great want of suitable buildings on farms generally has attracted much attention of late, particularly that of covered yards, making your correspondent's remarks well timed. Let us hope those who may contribute on this point will not confine themselves to large, but rather give preference to small holdings, from 150 acres upwards. Subjects appertaining to estates management are many, and it is to be hoped opinions may be freely given, not merely following the already well-beaten path, but throwing out new, though it may be crude ideas, which may be moulded into some practical form during discussion. It would be as well that some subjects were hinted at, with the space you could place at their disposal, as a guide to those willing to assist, thus,—

Draining of land;

Laying down of arable land in grass, drawing comparison between food-producing power of such land under grass *versus* arable culture;

Deep cultivation, its effects on the soil, mechanically and chemically;

The organic or inorganic constituents of grain, straw, roots, &c., whence derived, or how increased? culture *v.* manure;

Are restrictions on the sale of hay, straw, roots, &c., a necessary rational method for maintaining the fertility of the soil?

AGRICOLA.

[Such articles as our esteemed correspondent suggests will be quite acceptable, and we will always do our best to afford them any reasonable amount of space.—ED.]

CLEARING LAND OF TREE ROOTS.

SIR,—Having almost daily inquiries from gentlemen as to the use of "tonite" in clearing land of tree roots, I cannot do better than give the information received from the agents of the Earl of Airlie and the Earl of Leicester, whose foresters are now using "tonite" in clearing land, with the results here given. I may remark, however, that Lord Airlie's forester had only given it one trial at the time he wrote, and having received the tonite only a few days before, this was the first trial, and his men had not got properly into the way of using it. I give the account of the experiments in the words of P. Geekie, Esq., Lord Airlie's agent, as he received it from his forester.

"Blasting Tree Roots on the Estate of Cortachy, December, 1877.

"Statement showing the result of experiments with 'tonite' against gunpowder on spruce fir roots. The roots in each case were cut all round at their extremities, in order to facilitate the throwing out as well as the breaking up of the roots.

"It is but fair to state that the ground on which the roots rested and the roots themselves were not in the most favourable state for testing the powerful effect of tonite.

"We give our short experience so far as we have gone; at the same time we have no hesitation in saying that with a few more trials with tonite in more favourable ground the result would be much greater.

"The understated figures show a difference of about 15 per cent. in favour of tonite:—

To 8 roots blasting with tonite, and 24 hours' labour . .	£0	18	9
To 8 roots blasting with gunpowder, and 40 hours' labour .	1	2	8

Showing a balance of 3s. 11d. in favour of tonite upon 8 roots."

This being a first experiment, it is even better than I expected, inasmuch as Mr. Geekie's men had had no previous experience, and the roots of the tree being cut all round was against tonite. Had Mr. G. got his men to bore the tree after they cut the roots he would have found much better results, or had he put the tonite under the tree without cutting the roots, there would have been some resistance, which is what tonite requires; as it was, all resistance was taken away, and the consequence was, it took 24 hours' labour to break up eight roots, when about one-half the time would have done it. As Mr. Geekie has several hundred acres of land to clear, and is going to use tonite for the purpose, he, and the intelligent young forester, will find that a few more trials will enable them to effect a much greater saving than they did at the first trial, although 15 per cent. on eight roots will be a good saving on an acre of land.

Forgetting the soft nature of the subsoil, I advised Mr. Geekie's men to place the cartridges beneath the roots, and the tonite having a downward tendency, wasted a good deal of its strength to no purpose: the fault was clearly mine, the forester, Mr. McDonald, believing that by cutting the roots all round it would facilitate their breaking up, which should only have been done if the stumps had been bored; it would then have broken them up and removed them from their beds at the same time.

Having written to S. Shellabeer, Esq., Lord Leicester's agent, asking him his opinion of the best mode of breaking up roots with tonite, he also kindly sent me the forester's letter as he received it.

Fortunately, Mr. Shellabeer's men have had a little longer experience with tonite, and the forester's intelligent letter will be read with interest by your readers, especially those who are interested in clearing land of tree roots. I give his letter verbatim.

"*Holkham, Norfolk*, 14*th January*, 1878.

"SIR,—In compliance with your request in reference to my experience with tonite, I beg to say that I have now raised about 140 oak-tree roots with it. I began by putting a charge under the roots as recommended, but found that owing to the loose gravelly nature of the subsoil here it was of little use.

"I then tried boring, and charged with a 2 oz. cartridge in the small roots and 4 oz. in the large ones, and found them do very well. Afterwards I thought I would try a 2 oz. cartridge in the large ones, and as I found them sufficient I use no other now, and with them I generally turn the roots out in four or more pieces. I would certainly recommend boring the roots wherever practicable, as I find that the more resistance the tonite has, the more effective it does its work.

"Considering its great strength, also its safety in manipulation, it is, in my opinion, the best agent that can be employed in removing tree roots.

"I am, sir, your obedient servant,

"S. SHELLABEER, ESQ., H. MUNRO."

"*Longlands.*"

As Mr. Munro very justly remarks, tonite is the best and safest agent that can be employed in breaking up tree roots. With a few minutes' instructions in its use, and a little caution exercised with the cap, any ordinary labourer can use it without danger, if the instructions are carefully followed. With a little experience in the best methods of using it, I have no doubt that a saving of from 30 to 50 per cent. can be effected by the use of tonite. The costly process of dragging roots away from their beds is entirely done away with, as tonite breaks them up in their beds. I shall be glad to give any gentleman willing to try it every information necessary.

17, *Queen Street, Leeds.* THOS. DINEEN.

UNDER FORESTERS.

SIR,—I am not sure if any under forester has yet had the courage to write anything for the pages of your Journal, but I trust you will find room for this letter from one of that humble but necessarily aspiring class, regarding a subject which must sooner or later engage the earnest attention of all foresters. I refer to the great difficulty at present experienced by under foresters in getting situations as master foresters. By way of illustrating what I mean, I will in a few words relate my own experience in this matter. I am at present employed on an estate in the east of Scotland, and during the six years that I have served here I have endeavoured to gain a thorough practical knowledge of my profession, and, along with this, I have read all the works on forestry which it has been in my power to purchase or borrow from an obliging neighbour, but as my wage has always been comparatively small, and my forester neighbours unavoidably limited, these opportunities for acquiring professional learning have not been many. Brown's "*Forester*" I luckily got the loan of, being beyond my means to purchase, and with considerable labour and patience I transcribed all the principal items of information contained in that valuable standard work.

Like most of my compeers I began life in a very humble way, but

before coming to this place I had the good fortune to spend three years in a good provincial nursery, where I learned all that it was necessary for me to know about the management of plants in the earlier stages of their growth, as well as the names, habits, and appearance of the rarer conifers, shrubs, &c., which have been introduced into this country, and I must say that the knowledge which I acquired then has been of the greatest advantage to me on many occasions since. Now I trust that it is not presumption on my part to have the ambition to endeavour to get a situation as head forester. I can only say that during the last nine years the thought that I might yet reach that goal has helped to cheer me on through many days of depressing hard work.

Such being the case, the question is, how am I to attain that object? So far as I have been able to learn, there are only two courses open for me to follow likely to lead to the desired result. The first is,—I must leave my present situation, and go into some of the Edinburgh nurseries, and labour there until something suitable turns up for me, as I believe for many years past the Edinburgh nurserymen have had the filling of a great many of the head places throughout Scotland. The second course is to try by some means or other to get into the service of some one of the influential and well-known foresters, who are often called upon to supply noblemen and other landed proprietors with head foresters. Now, sir, for reasons which I need not state here, but which are perfectly legitimate and satisfactory, it is utterly impossible for me to adopt either of the courses referred to, and I know that many of my fellow-workmen, who are just as anxious as I am to push their way, are in somewhat similar circumstances. Since this duty has been thrust upon nurserymen, I have no doubt at all but that they have done it to the best of their ability, and with the utmost impartiality, as well as in the case of the other gentlemen referred to. However, it is high time that this most important business should be arranged in a more accessible and satisfactory manner, in the interest of those more immediately concerned. In furtherance of this object I would suggest what appears to me to be a simple but effectual remedy for this anomalous state of affairs.

The Scottish Arboricultural Society should draw up a list of subjects which it considers essentially necessary for every forester to know, and also appoint a board of properly qualified examiners, who would be charged with the duty of examining young men, who were desirous of qualifying themselves as master foresters, upon their knowledge of these subjects, these examinations to be held at such times and places as would be considered most suitable and convenient for all parties; and if a full register were kept by the Society of all the young men who successfully passed these examinations, I think that landed proprietors would only be too glad to secure the services of men thus accredited. If something like this were set agoing by such an influential Society, it would give every young forester in the country a fair chance of bettering his condition, and attaining the position for which he is best qualified. For surely it is a most humiliating thing, that after a young man has done all in his power to fit himself

for a position of trust and responsibility he must either go a-begging for patronage, or else remain an obscure labourer all the rest of his days.

I would say, further, that one reason why the science of forestry lags so much behind in this country is the fact that as yet there is no clearly defined course of study marked out for young men who wish to rise in their profession. For the most part they are left entirely to their own resources in the matter of technical education and self-improvement. The School of Forestry, which I expect to see created some day, will no doubt remedy this, but that institution is, I fear, yet a long way off; so that in the meanwhile I trust the Scottish Arboricultural Society, amongst its other efforts for the advancement of a science dear to us all, will give its immediate attention to the question of helping forward young men in the way I have roughly sketched out. By so doing it will inaugurate a system of training that will have a most salutary effect in stimulating young men to earnest work and study, and, as a consequence, be the active means of raising the status of foresters, and thereby exert a highly beneficial influence in every department of British arboriculture.

UNDER FORESTER.

CORSICAN PINE AND GROUND GAME.

SIR,—In the *Agricultural Gazette* of April 18th, 1874, I read that rabbits and hares would not touch the Corsican Pine (*Pinus laricio*). As these pests largely exist in woods under my management, I determined to give these trees a trial, more especially as I am informed that the timber of these pines is very good, and equal to larch; that they are also quick-growing. Accordingly, in 1874 I planted a few trees, about two feet high, in an open place in the centre of woods nearly 1,000 acres in extent: this spot I selected as being in the heart of the chief game preverves. These trees are at this date growing well and strongly, and have never from the time of planting till the present been touched by hare or rabbit. When they had so stood for a year I took courage, and in 1875 I planted about 1½ acre of open space (in the same woods, but about half a mile distant from the twelve planted) with the same pine, purchased from the same nursery, of equal growth, and similar in every respect to the first. The rabbits and hares attacked them at once, and within a short time there was not an undamaged tree on the ground.

Can you or any of your readers give a reason for the wholesale destruction of the second planting; also of any experience any may have had as to the durability of this pine when used as timber?—A. C. G.

AXE *versus* SAW FELLING OF TIMBER.

SIR,—In reference to the primitive method of axe-felling a large tree as expressed by your able contributor Mr. J. C. King, in the *Journal of Forestry and Estates Management*, at page 624, I beg to state

that I will guarantee that not a single wood merchant in the Midland counties could be found who would allow his lot of large timber trees, which he has purchased growing, to be felled by the saw in preference to the axe, knowing as he does that saw felling is thoroughly impracticable for all kinds of large park and hedgerow timber. The after-growth spoken of is a secondary consideration, and has nothing whatever to do with the question as it stands, viz., the best way to fell a large tree, say an ash; and in nine cases out of ten would not be required unless it was in the case of forest timber. As to the question of measurement, it is an utter impossibility to obtain more measurement in the tree if the plan of felling as advocated on page 580 of the Journal is strictly followed out.

Hawkstone, Salop. RICHD. JANDRELL, *Forester.*

SIR,—As this is a subject of the utmost importance to young foresters it is but right that those who have to learn should be so taught as to have a clear understanding of which is the best way to fell a tree. Surely it is that which can be done quickest and easiest, with the least possible waste of timber, considering that labour is scarce and dear, and time is money. At page 580 of the *Journal of Forestry* Mr. R. Jandrell condemns Mr. J. C. King's views, and puts forth his own experience as the *best* method to be followed if we want to do the thing well. Let us consider the two ways in detail, and then some of your timber merchant readers will perhaps kindly say which they prefer.

First method, *by the axe;* and, as Mr. J. says, let the workman with his mattock clear away all soil from round the stem of the tree, well down on the spurs, so as to be as low as there is any timber in the tree, which, in the generality of cases, will not be more than a few inches below the level of the surrounding ground. Then with his axe he will lay in all the roots level with the ground, and perpendicular with the bole of the tree. The next thing is to see which way the tree is to fall, and put on a rope or do any crippling that may be considered necessary, if it has not been done previously. First cut the tree half through on that side to which it is intended to fall, then cut the other side as far through as is considered safe before pulling the rope. This cutting should only be done on two sides, first with the right hand, then with the left, or by a right and left-handed man working at it at the same time. The tree down, there is a considerable time taken up in dressing the butt, which will be of a wedge shape. It may be nine or eighteen inches long according to the size of the tree, but when squaring and measuring the tree the half or the whole of this wedge has to be deducted; consequently, what with cutting, dressing, and squaring of the tree, about a foot in length of the best of the timber is lost to the disposer.

Second method, *with the saw;* the operator commences his work the same as with the axe, viz., clears away the soil and lays in the roots as low as it is considered there is any timber in the tree. (This preliminary work is too often neglected, which both loses timber and leaves unsightly stools.) This done, it must next be settled which way the tree is to fall,

and with the axe take out a horizontal mouth (or lay) close to the ground on that side of the tree to which it is wanted to fall. The said mouth must be cut two or three inches deep into the tree (according to its size), and make a nick on each side to prevent the tree from splitting. Then two men on their knees with the cross-cut saw commence on the opposite side to cut parallel with the mouth, keeping about an inch above the roots so as to save the men's hands from injury. A lad or man with a rope to assist in drawing the saw at the cutting end will be found an advantage if the tree is large. When the saw is a little over the back into the tree, an iron wedge should be introduced, and driven in occasionally with a mallet to allow the saw room to work freely. If the tree leans to one side the wedge should be driven in nearer to that side, and also the saw cut should be most forward on the same side, leaving the wood stronger on the opposite side to counteract the incline of the tree. Trees can be felled with great safety and precision by this method. I have often seen a stake set up and driven into the ground by the tree being cut so as to fall right on the top of it. There is no waste of either time or timber by this method, the butt requiring but little or no dressing, and as for the defects of the tree, which R. J. speaks of as being easier seen, the properties of a *good* tree will also be more visible.

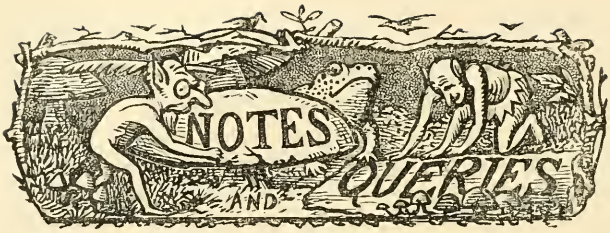
While on this subject I beg to draw attention to the system of felling hedgerow trees in England with the axe. I invariably find the men first cut four or six feet of the hedge away on both sides of the tree, to allow the operator room to work his axe. In Scotland, where they are cut by the saw, this destruction of the fence is not necessary, and twelve months after the tree is removed one cannot tell there had been a tree growing on the spot. J. C.

TREE-FELLING SAWS.

Sir,—In your last issue (page 623) Mr. King states that the saw used for felling timber "is generally an old pit saw with gullet-neck, teeth, &c." I must say, with all deference to Mr. King and his ideas on the subject, that practical woodcutters would never think of using such a tool as described, so long as a saw could be got that would perform the work in less time and with greater ease to themselves.

The common cross-cut saws are those principally used for felling, and they have a wooden handle at each end, projecting at right angles to the back edge of the plate. They have various styles of teeth, but the "peg-tooth'd" which cuts one way, and the "lance-tooth'd" which cuts both ways, are those now mostly used. I prefer the first mentioned for felling, and the latter for cross-cutting. When they are properly "trimmed," and in the hands of expert workmen, it will be only in exceptional cases that wedges will be required, and it will not be found necessary to use oil except when cutting resinous timber; then, if the resin sticks to the saw, a little paraffine oil rubbed on to it will be found the most effective method for keeping it clean and making it work freely.

Wyreside Cottage, Lancaster. Andrew Slater, *Forester.*



[*The Editor requests the assistance of Readers in answering Queries, so that the usefulness of this Department may be maintained.*]

PRIVET.—In reply to W. C. L. C., page 658, I would recommend him to cut the privet close over by the ground, and let it grow up again until 4 or 5 feet high, nice and bushy, then serve it in the same way. Fagot the wood and sell it for fuel. The money it brings will go a long way towards paying expenses.—J. W.

ROOTS CHOKING DRAINS.—Being a constant reader of your valuable Journal, I observe in the last volume, page 659, "Inquirer" wishes to get the opinion of one who may have been able to prevent the roots from choking drains, and still to allow the free ingress of water to the pipes. A friend of mine was for many years troubled with a drain that conveyed the water from his steading to a field near by. Four large saugh or willow trees grew within 15 feet of the drain and choked it yearly, till at last, when the drain was as usual being cleared of the roots, and the pipes having been again laid in their places, the drain was filled to the top with engine ashes. It has not been opened for the last five years, and how much longer it will keep clear remains to be seen. "Inquirer," I presume, wishes the water to have free ingress through the whole body of the drain to the pipes; had this not been his motive I would advise that the ashes be mixed with coal-tar to the state of mason's mortar, and then to put a 4-inch layer along the pipes, which in a short time will become as hard as cement, and quite impenetrable.—J. R.

Use collar pipes and cement them, or else, if the fall will allow, make an open dyke through your plantation, and have it periodically cleaned. I have tried both methods with success.—SUBSCRIBER.

PRICE OF CHARCOAL.—Would some of your readers favour me with the average price per ton of good charcoal?—A WELSHMAN.

CUTTINGS OF TREES AND SHRUBS.—I should much like to see something in the Journal concerning the making of the different kinds of cuttings, when and how they ought to be made, the best length for the various kinds, the position in which they should be inserted in the

ground, the number to the yard, and the distance between the lines. Is a moist soil with plenty of leaf mould the best to lay poplar cuttings into to ensure success? In the October number, page 422, we are instructed to plant cuttings of poplar about 18 inches in length taken from the last year shoots, and leave them about 6 inches above the ground. Surely this does not refer to planting cuttings in the nursery? A much shorter length than 18 inches would do as well. Some writers say, "Do not make cuttings when they are wet with dew;" will making them when wet, or making them in frosty weather, injure them? Is the month of February too late to plant cuttings in the nursery? I should also like to see a list of plants that can be raised from cuttings.—David Barclay, *Sorn Castle, Mauchline, Ayrshire.*

[The month of February is not too late to put in cuttings in the nursery. There is no necessity to make any cuttings when wet with dew. It does no harm to them, but makes a dirty job for the operator. Most hardy cuttings are made in frosty weather, because it is an operation which can be carried on within doors, when workmen can do nothing in the open nursery. Cuttings of such plants may be "taken off" in a frozen state, but they ought always to be dipped in cold water till thawed, and then be allowed to dry before being "made." No prudent nurseryman waits to take off his cuttings till a frosty day comes, but has them ready and laid-in, in a sheltered place, against that event. A "list of plants that can be raised from cuttings" simply means a *Botanical Dictionary.* Get Johnson's *Gardener's Dictionary,* 6s. 6d., Bell & Daldy, London.—Ed.]

The Best Willow for Cricket Bats.—Could any reader inform me which is the best kind of willow for making cricket bats? Such willows sell very well, and are worthy of cultivation where the land will grow them without the heart-rot. Please to name the different kinds which can also be recommended for the same purpose.—J. W. S.

Bitter Willow.—I beg leave to thank those gentlemen (Messrs. Scaling & D.) who kindly answered my late enquiry in your columns (p. 509) respecting a fence of bitter willow. Perhaps it may interest your readers to read another reply to the same query, obtained through the kind co-operation of a contemporary. The following is the extract.

"I suppose from what——says, that he wants to make a fence of willow, hoping to get some profit from them. He can make a fence with them very well, if the ground suits, but to do any good he must grow them so that he can twine the branches into one another. In this way, and keeping them properly cut and twined, he may get a good fence as the ground is moist, and after a time have plenty of shoots to cut."—Subscriber.

Books.—In reply to "A young Forester anxious to learn." I would say get Grigor on Arboriculture, if you cannot afford Brown. It is excellent as far as it goes, but lacks the completeness of the latter work. The price I believe is ten shillings.—Subscriber.

Prizes offered in 1878 by the Scottish Arboricultural Society.

The following is a list of the subjects arranged by the Council of the Scottish Arboricultural Society, for competition during 1877-8.

I. For the best and approved Report describing fully the tools at present used by Foresters in Britain. (Prize of Three Guineas offered by the Proprietors of the *Journal of Forestry and Estates Management.*)

II. For the best and approved Essay on the Peeling and Harvesting of the different kinds of Native Bark used in Tanning. Competition confined to Assistant Foresters. (*A Medal.*)

III. For an approved Report on the most extensive, complete, and judiciously arranged Arboretum. (*A Medal.*)

The author must describe the positions as to soil, exposure, elevation, &c., of the respective species of varieties of trees reported on, and state their ages, treatment, cost, and mode of planting adopted.

IV. For an approved Essay on the present state and future prospects of Arboriculture in the county in which the competitor resides. This is a standing subject. (*A Medal.*)

V. For an approved Report on the Old and Remarkable Trees on the estate on which the competitor resides; correct measurements of the circumference of the trunks, at 1 foot and 5 feet from the ground, must be given; also height of tree, spread of branches, &c. Photographs are desirable. (*A Medal.*)

VI. For an approved Report on the Summer Operations most beneficial to plantations and woodlands.

The report to embrace such subjects as pruning, thinning, transplanting, training, &c., with special reference to the effects produced by them while the trees are in full growth and leaf, compared with similar operations performed while nature is dormant. (*A Medal.*)

VII. For an approved Report on Plantation Enclosures of any New Construction, and their management, cost, and durability for various situations.

The Reporter will detail the various modes of protecting plantations, their comparative cost and expense of maintenance, whether live fences, palings, or walls. (*A Medal.*)

VIII. For the best and approved collection of Cones ripened in Britain during 1875, 1876, and 1877-78. (*A Medal.*)

Each cone (or series of cones of one species) must be accompanied by a label giving the name of the species, the estate and county where produced,

and the year grown. The Prize collection to become the property of the Society.

IX. For the best and approved collection of Seeds of Forest Trees and Shrubs ripened in Britain. (*A Medal.*)

Each example of seeds to have a label, giving the name of the species, and where produced. The Prize collection to become the property of the Society.

X. For the best and approved collection of prepared sections of different kinds of wood grown in the county in which the competitor resides. (*A Medal.*)

Each section must have a label attached, bearing the name of the wood, the estate and county where grown. The Prize collection to become the property of the Society.

XI. For the best and approved series of Geological Specimens illustrating the different rocks and formations on which Forest Trees and Shrubs grow in the county in which the competitor resides. The specimens to be accompanied by a Report. (*A Medal.*)

The successful collection to be the property of the Society. Buteshire having been already reported on, is excluded.

XII. For an approved Report on the Plantations of which the competitor is Forester. (*Three Medals.*) One to be awarded for the best Report from each of the countries—England, Scotland, and Ireland—and competition to be confined to each country respectively. Reporters must state the extent of plantations under their charge, the kind of timber grown, soil, situation, management, age, &c. This is a standing subject.

XIII. For an approved Report on the Forests of the United States of America. (*A Medal.*)

XIV. For an approved Report on the Forests of India. (*A Medal.*)

XV. For an approved Report on the Forests of any of the British Colonies. (*A Medal*)

XVI. For an approved Report on the Management of Forests on the Continent of Europe. (*A Medal.*)

Special reference to be made to any appliances or modes of culture and treatment not generally adopted in this country, but followed in such Arboricultural schools as those of Nancy and Hanover, and elsewhere. Foreigners are specially invited to compete.

XVII. For an approved Report on the Diseases most incidental to Forest Trees, including those that affect the roots as well as the bark, branches, and foliage. (*A Medal.*)

XVIII. For an approved Essay on the Natural History of *Adelgis laricis*, the Larch Bug. (*A Medal.*)

The Essay must include the injury done by the insect to larch, and suggest remedies.

XIX. For an approved Report on the results obtained by experience of Seedlings of Coniferæ, being the produce of trees grown in Britain, as compared with plants obtained from foreign-ripened seed. (*A Medal.*)

XX. For an approved Essay on the Best Methods for Seasoning Different Kinds of Timber. (*A Medal.*)

XXI. For an approved Essay on the Best Methods of Rearing Timber Trees in Deer Forests for shelter. (*A Medal.*)

XXII. For the best and approved Model of a Rustic Arbour or Summer-House, designed and executed by the Competitor. Model not to exceed three feet in height. (*A Medal.*)

XXIII. To any Member of the Society who shall send to the Secretary from abroad, cones or seeds of Forest Trees of new or rare species of varieties, capable of germination, and of thriving in this country. (*A Medal.*)

To be awarded when fifty of any sort, or fifty plants in all, have been successfully raised. These plants to be the property of the Society, and to be balloted for amongst Members intimating their desire to have them. The packages to be delivered free of cost to the Society at any British port.

XXIV. For an approved Essay or Report on any subject connected with Arboriculture. (*A Medal.*)

XXV. For any marked advantageous improvement on any of the Implements used in Forestry. (Models or Implements to be accompanied by a Report.) (*A Medal.*)

The Judges are empowered to fix the value of the Prizes to be awarded according to the respective merits of the Essays.

All Essays and Reports intended for Competition must be given in to the Secretary not later than 24th September, and all Collections of Cones, Seeds, Woods, Geological Specimens, and Rustic Work, not later than 22nd October, 1878—*each collection bearing a motto, and being accompanied by a separate sealed envelope bearing the same motto outside, and containing a card with the name and address of the Competitor.*

Judges cannot compete during their term of office. Bye-law VI.

Successful Competitors may either have the medals or their converted values, which are as follow: Gold, £5; *No.* 1 *Silver* (*medal and* £1 *in money*), £3; No. 2 *Silver*, £2; *Bronze*, 10s. *Bye-law X.*

JOHN SADLER,
Secretary.

Ransome's Tree-Felling Machine.

In a former number of this Journal this new and important machine was fully described and illustrated, but since that time the patentees, Messrs. A. Ransome and Co., Stanley Works, Chelsea, S.W., have been making several improvements in it, the results of which were practically demonstrated in a public trial held on the Roupell Park Estate, near London, on the 11th ult., in the presence of a number of landed proprietors, timber merchants, engineers, &c. The first trees to be experimented on were a row of fair-sized elm, varying in diameter from 2 to 3½ feet, and good sound timber.

The machine having been placed in position, steam was turned on, and the saw went quietly and rapidly to work without a single stoppage till the tree trembled, and then toppled over, in the short space of 3½ minutes from the time of commencing sawing. The diameter of this elm was 33 in. The machine, which weighs between 3 and 4 cwt., was then slung on two poles with ropes and carried by four men to the next tree, another elm about 3 feet in diameter, a distance of a few yards only, and the fixing having been quickly completed, the saw again got to work, and the tree fell in about nine minutes, there having been a slight stoppage through the saw not being properly ground. Two other trees of similar dimensions were then felled in about the same time, the four having taken rather less than an hour from the time of starting, and having been operated on without disconnecting the steam pipe. In a private trial, which was held on the previous day, five trees were felled in thirty-five minutes, including the time occupied in moving and fixing the machine.

The next row of trees to be operated on was at some little distance, and was awkwardly situated close against a wall, but after a slight delay the machine was successfully fixed, and the boiler having been moved and the steam-pipe again connected, work was resumed, and the trees, which were of smaller diameter than those previously mentioned, came down rapidly, their fall being guided by ropes.

It will be seen from this trial that the saving over axe-felling in point of time is considerable; as regards the expense it is rather premature to speak at present, but exclusive of the first cost of the machine, which is but small, and the boiler, it appears that the working expenses need not exceed £1 5s. to £1 10s. per day, and Mr. Ransome, who himself superintended the experiments, expressed an opinion that, under favourable circumstances and with practised men, the machine would fell from 50 to 60 trees of 30 in. diameter in an ordinary day's work.

Highland and Agricultural Society.

The annual general meeting of this prosperous Society was held in Edinburgh on the 16th inst., the senior director present; Robert Hutchison, Esq., of Carlowrie, presiding. In remarking upon the excellent progress the Society has made during the last twelve years under the management of the energetic Secretary, Fletcher N. Menzies, Esq., the chairman said that the members had increased from 3,924 to 4,600; the income from invested capital, annuals, and life subscriptions having increased from £3,977 8s. 11d. to £4,553 8s. 3d.; and the premiums offered at the general shows have increased from £1,600 to £2,763 16s. during the same period. The interest taken in the Society's objects, and the attendance at its exhibitions, have also very largely increased. After electing the large number of 121 new members, and the transaction of the usual business of the meeting, C. J. Mackenzie, Esq., of Portmore, announced

that the following premiums had been awarded to Agricultural Reports in 1877:—£30 to Duncan Clerk, writer, Oban, for a report on the agriculture of the county of Argyll; £10 to the Rev. John Gillespie, Monswald Manse, Dumfries, for a report on the Galloway breed of cattle: £10 to George Armatage, M.R.C.V.S., Hertford, for a report on hoose or husk in calves and lambs; £10 to George Armatage, M.R.C.V.S., Hertford, for a report on strangles; £10 to J. B. Smyth, forester, Duff House, Banff, for a report on the comparative return from capital invested in cropping, grazing, or planting land upon hill or moorland; the minor gold medal to James M'Donald, *Scotsman* reporter, Aberdeen, for a report on American agricultural colleges.

Mr. Mackenzie also intimated that the following premiums would be offered in 1878 in agriculture:—On the agriculture of the counties of Clackmannan and Kinross, £20; on the agriculture of the county of Sutherland, £30; on the agriculture of Bute and Arran, £30; on the history of leases of lands and farms from the earliest times, £25; on the physiological distinctions in the condition of the Scottish peasantry, £30; on the system that best provides a sufficient supply of labour during press of agricultural work, £10; on the results of experiments for fixing and retaining the volatile and soluble ingredients in farmyard manure, £20; on the advantage of ploughing in manure at once on being spread, £5; on manures produced by different kinds of feeding, £20; on manure made with and without cover, £20; on improved varieties of agricultural plants, £50; on the cultivation of cabbage as a field crop, £10; on the insects which prey upon agricultural plants, £20; on the vegetable productions of India, China, and America, £10; on the adulteration of agricultural seeds, £10; on the wet season of 1877 and its effect on vegetation and crops generally, £10; on the best modes of housing and fattening cattle, £20; on the comparative advantages of grazing cattle and sheep together or separately, £10; on different descriptions of food for stock, £20; on the Cheviot breed of sheep, £10; on the breeding of horses for road or field, £10; on the adaptability of the various soils to the breeding and rearing of horses, £10; on the effect of sewage upon the animal system, £10; on a description of any scheme whereby town sewage has been successfully utilized for irrigation in agriculture, £20; on animal parasites, £20; on rural economy abroad susceptible of being introduced into Scotland, £10. *Estate Improvements:*—On the general improvement of estates by proprietors, £10; on the most approved farm buildings by proprietors, £10; on the reclamation of waste land by tillage by proprietors or tenants, £10, £10, and £5; on the improvement of natural pasture, without tillage, by proprietors or tenants, £10 and minor gold medal. *Machinery:*—On the invention or improvement of implements of husbandry, £50; on the best and most approved cattle truck for feeding and watering the animals in transit, £20.

In the Forestry Department, the Chairman of Committee, Professor Balfour, reported that the following premiums had been awarded in 1877:—The gold medal to Sir Simon Macdonald Lockhart of Lee and Carnwath, Bart., for planting on the estate of Carnwath, Lanarkshire. The medium

gold medal to Robert Hutchison, Esq., of Carlowrie, Kirkliston, for a report on the *Abies Menziesii*, and its value for planting in Scotland. The minor gold medal to James Duff, forester, Bayham Abbey, Kent, for a report on the utilization of waste forest produce.

Professor Balfour then announced the following premiums offered by the Society for competition in the FORESTRY DEPARTMENT in 1878:—On extensive planting by proprietors in Scotland, £10; on planting on peat bog, £5; on forest trees of recent introduction, £5; on the *Picea nobilis* and its value for planting in Scotland, £5; on the varieties of trees best adapted for planting as shelter in the islands of Scotland, £5; on the growth and cultivation of willows in Scotland, £5; on the old and remarkable Spanish chestnuts in Scotland, £10; on the cutting and transport of firewood, £5; on the cultivation in Scotland of charcoal-producing plants, £5; on the cause of ring-shaking in trees, £5; on the woods, forests, and forestry of Perthshire, £10; on the woods, forests, and forestry of Ross-shire, £10; on the woods, forests, and forestry of Inverness-shire, £10; on the comparative advantages of high forest and coppice, or coppice with standard trees, £5; on the utilization of waste produce of forests and woodlands for making an artificial fuel, £10; on the insects most injurious to forest trees, £10.

The late Andrew Murray, F.L.S.

WE have to record the death of a naturalist whose later life has been mainly occupied in close scientific observation upon the injury done by insects in our fields and gardens. As farmers and gardeners know but too well, crops at every stage, from the time they are sown till they are gathered in, are subject to depredatious from insects, and when stored up they are still so ravaged, but the tiller of the soil has not known how to meet his foe, and has even confounded friends with foes by not knowing the metamorphic phases through which insects pass. Connected officially with the Royal Horticultural Society, to whose scientific committee questions respecting damage to crops were often referred, Mr. Murray was so impressed with the general ignorance of insect life that he made suggestions to the Privy Council which led to the formation of a collection of economic entomology, under the direction of the Science and Art Department. This collection, now for some time past at the Bethnal Green Branch Museum, was referred to in the *Times* of September 16, 1876, and was intended by Mr. Murray as a type museum for instruction in agricultural districts. Its formation had occupied the greater part of his energies for years past, and his last few days at work were devoted to its completion. There have been differences of opinion as to how far legislative interference, if any, should be carried with regard to insect destruction, but all who have discussed the subject recognise the great value of the collection which, through Mr. Murray, the Privy Council have made. Other natural

history subjects, of less direct practical importance, occupied his attention at earlier periods of his life. In 1866 he published his well-known "Geographical Distribution of Mammals," in which he brought together such facts as were known, and illustrated the distribution by coloured maps. Although he was trained at Edinburgh as a writer to the signet, he showed a preference for natural history, attending by choice the natural history lectures, and on the death of Professor Fleming he for one season lectured at the New College, Edinburgh. In 1858-9 he was elected president of the Royal Physical Society, and he filled also the office of president of the Royal Botanical Society of Edinburgh. His first paper was printed, not in Britain, but in France, in the Transactions of the "Société Entomologique de France" in 1851, and since then he has been a frequent contributor to learned societies and to periodicals. His monograph on the *Nitidulidæ* was a remarkable specimen of long and patient work. Mr. Murray was the son of Mr. William Murray, of Conland, and was born in Edinburgh in 1812.

THE STRAW TRADE.

THE greatest development and expansion of the trade was brought about by the invention of a most important little machine called the straw splitter, which appeared about 1806. The straws could by its use be separated into so many equally sized splints, from four parts up to nine. The invention of a host of different kinds of plaits, in a variety of designs, followed the introduction of the machine, and the ingenuity and taste of the plaiters soon raised the value of straws plaits, some kinds realizing as much as £1 per score. The peculiar nature of the soil in Bedfordshire producing the finest kinds of wheat straw, it has become the chief seat and centre of the trade. The preparation of the straws and straw plaiting is done in the villages and districts, principally by the agricultural portion of the population, through the counties of Bedford, Hertford, Buckingham, and a portion of Essex. Each plaiting district has its own special plait peculiar to it in a greater or lesser degree; thus Hitchin is noted for its broad twists; Ampthill for narrow double straw plaits; Tring, Wing, and Ivanhoe for narrow twist, rustic, and mixed coloured plaits; Chesham for its fine split; Vienna, moss edge, and purls; Berkhampstead for China, purl, rock, Coburg, and moss edge, &c., &c. It may be matter of surprise for our readers to learn that not less than 50,000 persons are employed in the various processes of manufacture, from the thrusting of the sickle into the waving corn, to the complete finish of the charming head-dress ready to deck the brow of the fairest in the land. The transformation of a hundredweight of almost worthless straw, of the value of a few shillings, into the choicest productions, varying from thirty pounds to forty and fifty, by the sole will of manual labour, has scarcely a parallel in the range of British industry. Hats and bonnets have been made from wood, paper, vegetable fibres, horsehair, fancy trimmings from Swiss looms, cordonnet,

manilla, silk, velvet and other materials; but none can compare in elegance, durability, and comfort, with a finely made English straw; as long as head-dresses are worn, straw will maintain the supremacy. One of the distinguishing marks of taste and culture is the selection of a bonnet, fine in quality and faultless in style. Dunstable more especially cultivated the production of the choicest specimens of manufacture, realizing the highest prices. Luton manufactures for the million, excelling all others for cheapness and quality, exporting large quantities of hats and bonnets to nearly every port of the world. The population has doubled itself since 1856, and the annual trade returns give little short of a million. The introduction of fifteen hundred sewing machines has greatly stimulated and increased the powers of production; the hats and bonnets being much more durable, and sold at a cheaper rate, will tend to increase the sale largely in all our colonial possessions, as well as the home trade and the Continent. The state of the straw trade will compare favourably with any other industrial centre in the kingdom.—*The Hatters' Gazette.*

SALES OF BRITISH TIMBER.

The following list of sales of British timber, already announced to take place during the month of February, is copied from the *Timber Trades Journal*:—BEDS.—J. Shilcock (Hitchin), 14th, at Luton; R. B. Stafford (Bedford), 8th, at Morhanger. BERKS.—A. Davis (Newbury), 6th, at Hampstead Norris; 8th, at Boxford; 11th, at Wickham. BRECON.—Thos. Price (Builth), 7th, at Builth. CAMBS.—E. W. Long (Cambridge), in Feb., at Whittlesford. CARDIGAN.—Thos. Griffiths (Cardigan), 4th, on Bronwydd Demesne; 5th, at Carmarthen. DEVON.—Helmore and Son (Exeter), 4th, at Crediton. Messrs. Hooper (Chagford), 5th, at Chagford. J. Hussey and Son (Honiton), 8th, at Yarcombe. A. C. Loveys (Moreton Hampstead), 14th, at Chudleigh. HEREFORD.— Pye and Sunderland (Hereford), 6th, at Hereford. IRELAND.—P. Smith (Curraghtown), 4th, at Ardsallagh Demesne, near Navan. KENT.—W. R. Tompsett (Tonbridge), 20th, at East Peckham. MIDDLESEX.—Marsh, Milner, and Co. (54, Cannon Street, E.C.), 14th, at Sunbury. NORFOLK.—Salter and Simpson (Attleborough), 4th, at Attleborough. NORTHAMPTON.—W. J. Pierce (Northampton), 7th, at East Haddon. OXON.—C. Simmons (Henley-on-Thames), 5th, at Lower Assenden. J. H. Beere (Banbury), 5th, at Wroxton. SALOP.—Barber and Son (Wellington), 5th, at Wem. STAFFORD.—Sollom and Barnett (Wolverhampton), 7th, at Wolverhampton. SUFFOLK.—C. W. Chaston (Mendham), 4th, at Flixton. SURREY.—Drewitt and Son (Guildford), 16th, at Guildford. WARWICK.—D. Holloway (Yardley), 8th, at Solihull. WORCESTER.— Smith and Righton (Evesham), 5th, at Honeybourne. Mr. Bentley (Worcester), 6th, at Ombersley.

Forest Songs and Poetry.

FOREST HAUNTS.

Ye olden oaks, deep clad in greenness vernal,
  With summer's sunlight on your rugged brows,
Methinks I hear the voice of the Eternal
  Go out amid the swaying of your boughs.

And oft unto your solemn shades retiring
  Of temple, altar, shrine, my heart to Him
Has poured the burden of its high aspiring
  In measured cadence through your cloisters dim.

As wayward child, touched by some anguished arrow
  From the full quiver of the coming years,
On mother's breast unbosoms wild its sorrow,
  While loving kisses dry the brimming tears;

So turn I, yearning for your dear caressing;
  World-worn and weary do I come again
To win some measure of maternal blessing,
  If but a brief forgetfulness of pain.

From life's fierce conflict, from its toil unending,
  Awhile to rest me where no care intrudes,
And feel my soul in quickened pulses blending
  With kindred souls that dwell in solitudes;

To lowly listen to the mystic voices
  That through your boundless sanctuaries ring,
And feel, while Nature in her heart rejoices,
  Some thrill of rapture in my own upspring.

These shall restore me to the pure and tender
  Of feelings sullied in embittered strife;
Some faint ray kindle of Hope's morning splendour,
  That shed a halo on each dream of life.

O gentle spirit that afar is hiding
  In unfrequented wilds of wood and glen,
Couldst thou as in these tranquil haunts abiding,
  Dwell in the homes and in the hearts of men,

I had not need to medicine this longing,
  With calm and quiet in your green retreat;
Life's stony paths, with weary pilgrims thronging,
  Were fair and flowery to these bleeding feet.

Tree Planting at Woolwich.—Some thousands of young trees have been received at the Royal Arsenal, Woolwich, from the Botanic Gardens at Kew, and are being planted in rows by the sides of the avenues and workshops, and grouped in plantations wherever there are plots of ground available. In a few years the appearance of the Royal Arsenal will be much improved by these trees.

Magnolia Campbelli in Ireland.—We forget how long it is since this magnolia, a mere stripling, was planted out at Lakelands, co. Cork, but little more, we should think, than six or seven years. So rapid has been its growth that when we saw it this autumn it was quite a tree, and in its noble leafage and aspect one of the most imposing we have ever met with. Merely regarded as a deciduous tree of fine proportions and faultless symmetry, and in its summer clothing decked with foliage exceptionally large and fine, the Lakelands specimen speaks forcibly of its value. But what if, in addition to this beauty of form and leafage, we take into account that in spring, before the leaves appear, it is the wont of the *Magnolia Campbelli* to have its every branchlet decked with glorious cupped flowers, measuring from 6 in. to 10 in. across, varying in colour from white to deep rose or crimson, and exhaling an agreeable fragrance! The Lakelands specimen has not yet flowered, but it will not be very long now, we apprehend, till it will afford the first opportunity of recording its flowering in these islands. We have heard doubts expressed, and read of them too, from time to time, as to this magnolia being sufficiently hardy for our climate, and this may in some measure account for its being yet so rare in our grounds. Is there any valid ground for the supposition? We rather think not, taking into account that its home is among the outer ranges of the Sikkim Himalayas, where it is found, according to Sir Joseph Hooker, in abundance as a great forest tree at an elevation of from 8,000 to 10,000 ft.; and further, that more than twenty years ago Sir Joseph did not hesitate to express his undoubted conviction that it would prove "hardy in England." Our own experience of its behaviour out of doors in this country goes a good way to show he was right in forming that opinion. With regard to soil and situation, it must be remembered that, unlike some of its American congeners, its home is the mountain side, not the oozy river bank or lagoon islet. We throw out the hint merely to suggest the probability of a somewhat open and elevated situation, and a lively soil, rich withal in vegetable matter, being more favourable to its wood ripening and early flowering than if planted in low and closely sheltered quarters, with a peaty or heavy soil to grow in. Those who have facilities for doing so would do well to put this matter to the test by planting one or more in these different situations. The Lakelands specimen is admittedly growing in a rather close and sheltered spot in companionship with an almost equally large example of *Idesia polycarpa.—Irish Farmer's Gazette.*

White Birch Wood.—Quite a large business is being done in the exportation of white birch wood from the New Hampshire forests to be made into thread spools. It is estimated that over a million feet were imported for this purpose last year to England, and the demand is increasing.

A Large Boiler.—A boiler, eighty feet long by six feet in diameter, and weighing seventy tons, is being constructed at Cleaveland, Ohio, for the U.S. Navy Yard at Charlestown, Mass. It is to be used for a new process of preserving the timber to be used in the construction of wharves and docks against the action of worms.

Royal Trees.—The planting of memorial trees has long been a favourite practice with the members of the Royal Family, and on the occasion of her Majesty's visit to the Premier, Lord Beaconsfield, at Hughenden, trees to commemorate this special mark of the Sovereign's favour were planted on the lawn by the Queen and the Princess Beatrice. The trees selected for the purpose were *Picea nobilis* and *P. Nordmanniana.*

A "Big" Saw-mill.—They have a saw-mill at Port Madison, Puget Sound, that is some at sawing long timber, ninety-foot sticks being quite common. Logs have been sawed that weighed twenty-five tons, and from which were made 6,000 feet of lumber. One stick was turned out that was 160 feet long, squaring 4 feet at one end, and 18 inches at the other; also a plank 60 feet long, 5 feet wide, and 6 inches thick.—*Lumberman.*

Teak Plantations in Madras.—The teak plantations at Nelamber, in the Madras Presidency, cover an area of 3,000 acres, the oldest portion of which has been planted 30 years. The total expenditure during that time, including purchase, and the lease of another 19,000 acres, has been £30,000, and the receipts for thinnings, &c., amount to £1,000. These plantations are now valued at £150,000, and Colonel Pearson, late Inspector-General of Forests, estimates their value, when mature, at the large sum of two millions sterling.

Effect of Smoke on Trees.—Mr. Alcock, who for many years past has been making experiments with trees planted in the vicinity of his cotton mill near Manchester, finds that the Oriental plane, which does better than any other tree in London smoke, will not grow at all in that of Lancashire; on the other hand, he has been very successful with the beech, sycamore, birch, wych elm, and Turkey oak, but the lime tree does best of all.—*Land and Water.*

Insects devouring Teak Leaves.—It is stated that the officers of the Forest Department of British Burmah are much exercised by the depredations of the larvæ of a moth which has recently appeared in vast numbers at Kyet-pyagon. The caterpillars when first observed were supposed to be a species of *Geometra,* but have since been identified as the larva species of Tortrix. They devour the leaves of the young teak trees with great voracity, and threaten eventual destruction to the extensive teak plantations, which the Government has been at such great expense and trouble to create and preserve.

Forests in Queensland.—Mr. Landsborough, the well-known Australian explorer, recently read a paper at Oxley, Queensland, in which he adduces a variety of interesting facts to prove that dense forests are on the increase in Australia, that the climate is becoming moister, and therefore improving, that the country is gradually ceasing to be favourable to sheep-rearing, and becoming agricultural, and seems to hint that in course of time the great

central desert may yet "blossom as the rose." Formerly when there were no sheep to keep down the grass, fires were frequent and terribly destructive to trees and all vegetation, but since the stocking of the country there is less grass for the fires to consume, and their ravages are consequently becoming limited in extent. Queensland, especially, Mr. Landsborough declares, is now so unfit for sheep-pasturing, that no one thinks of making a living by them. The observations of this experienced traveller are well worthy of attention, and it will certainly be interesting to watch the changes caused by the presence of civilized men in Australia, as we know exactly its condition at their first advent.—*Nature.*

Serious Ravages of the Borer.—Mr. Fink, gardener in chief at Washington Park, in this city, says the *Albany Cultivator*, brought to our notice last week a very curious instance of the destruction of young trees by the borer. He had set out last spring 1,000 Austrian and Scotch pines, but notwithstanding watering, mulching, and the best of care, they were found to be drooping, and finally 800 of the number were evidently dead. Examination showed that their stems, in some cases to a height of twenty inches from the ground, were full of borers, as many as two hundred having been taken out of a single tree. It is possible that in their full vitality most of the trees might have survived and outgrown the attack, but coming as it did when their vigour had been checked by transplanting, it proved fatal.

The Indian Irrigation Works.—Before the Indian Government spends millions in irrigation works as a means of averting famine for the future we trust the proposal will be well considered. Irrigation works may be most desirable in some places where rice is the staple crop, but in localities where dry grains, such as millet, rape, and pulse are grown, other systems must be employed. The Forest Conservators may do much good by stopping indiscriminate feeling, reafforesting denuded tracts, and thus keeping the springs up to their level. The indigenous plants, especially the grasses and forage plants of the country, should be more attended to, the ryots protected in their industry from usurers, and the general routine of Government administration simplified.—*Gardener's Chronicle.*

Large Cork Tree.—In the kitchen-garden at Somerstown House, Cork, the residence of Mr. Alexander, there is what is, perhaps, the largest cork tree that exists in Great Britain or Ireland. The following are the measurements which I made of it last week:—Girth at 1ft. above the ground, 13 ft. 5 in.; girth of trunk at 7 ft. above ground, 15 ft. It branches out at the last-named height. The arms are very large, the girth of one being 7 ft. 5 in.; the spread of the branches is over 60 feet, and both trunk and branches are covered to a great depth with cork bark.—*Gardener's Record.*

Large Araucarias.—From letters we have received respecting large araucarias we gather that the finest tree in England is the splendid specimen at Dropmore, which exceeds 60 feet in height, and is about fifty years old. There are also very fine examples at Messrs. Mitchell's nurseries at Piltdown, also in the great Berkhampstead nurseries of Messrs. Lane. Seed has been ripened and seedlings raised in those nurseries, also at Strathfieldsaye (the Duke of Wellington's), Warfield (Lord Ormathwaite's), and at Bicton (Lady Rolle's), where very fine trees may be seen. The trees are generally diœcious, but at Bicton and at Castle Martyr (Earl of Shannon's) both male and female catkins have been produced on the same trees. Seeds have been ripened in Scotland

at Castle Wigg, Wigtonshire, but the finest tree in Scotland is, we think, at Keir (Sir W. Stirling Maxwell's); it exceeds 50 feet in height. The largest tree that we have heard of in Ireland is at Woodstock. It was planted by Col. Tighe fifty years ago, and exceeds 50 feet in height. There is also a very fine specimen in Mr. Boyd's garden at Ballymacool, co. Donegal. The largest tree we have heard of in the Isle of Wight is in Miss Johnson's gardens at Willow Bank, St. John's, Ryde. We should be glad to hear the exact height of those trees, and of other noteworthy specimens.

The Arnold Arboretum.—A tract of land at Jamaica Plain, Mass., of about 130 acres, is assigned by Harvard University to the Arnold Arboretum, of which Prof. Chas. S. Sargent is the able director. It being desirable to have the land laid out to the best possible advantage, and the income from Mr. Arnold's bequest not being equal to any extraordinary expenditure, Mr. Fred. Law Olmsted, so favourably known as a landscape architect, volunteered his services for the work, and a few of the wealthy gentlemen of Boston and vicinity have volunteered the few thousands needed to pay the surveyors and draughtsmen. Thus this important preliminary work will be accomplished without drawing upon the proper income of the fund, and in a manner so thorough that it cannot fail to be of the greatest value to the Arboretum—an institution to the development of which arboriculturists and lovers of trees, not only in America, but abroad, look with the liveliest interest.—*American Agriculturist.*

Arbutus Unedo in Yorkshire.—At a distance of four miles from the east coast, and at an elevation of 500 feet, this very handsome evergreen sub-tree or tree-like shrub is perfectly hardy, but it flowers so late as to have them destroyed, which may, however, be due to the imperfect ripening of the wood, quite as much as to the late flowering and cold. At an elevation of about 200 feet above the sea, and distant about a mile and a half, it fruits very freely and regularly, being sheltered from north winds by plantations at a short distance, and having a southern exposure. Beautiful as are the berries of *A. unedo* at this dull season, they are surpassed by Croome's Scarlet (*Arbutus unedo Croomei*) and the Scarlet (*A. unedo ruber*). Excepting near the coast, and there even in high and exposed situations, positions in front of buildings with a south exposure are necessary for the fruiting of these very desirable evergreens. *A. Andrachne* is very handsome; it has bright orange berries in clusters, which are very ornamental, the tree being remarkable for casting its bark annually, leaving a smooth red trunk. Birds of the thrush tribe have a particular relish for the fruit, which they devour greedily. I may mention that *Cotoneaster Simmonsi* is loaded with its orange-red berries; the erect form of the bushes and bright berries have a fine effect as seen among the dark monotonous forms of evergreens which usually preponderate in pleasure-grounds.—G. Abbey, *Journal of Horticulture.*

Madras Forests.—The subject of forestry in Madras will most likely claim special notice when the pressure of famine is over. Opposition has been offered by some members of the Madras Government to all proposals for a satisfactory demarcation of forest tracts and to their permanent maintenance as reserves; the consequence is that extensive denudation of hill ranges is going on, the outcome of which will be the drying up of many important streams, with increased liability to famine and all its attendant horrors, during the prevalence of a dry season.—*Indian Agriculturist.*

In the course of the present and the early part of next month prompt attention should be given to effect a thorough clearance of all dead and decaying wood and fallen *débris* from woods and plantations. The season's fallings and thinnings will have been completed, and tree-planting finished, so that an opportunity can now be had for the performance of this most important, but too often sadly neglected operation. No plantations can be considered to be well managed where prunings, thinnings, fallen branches, or other *débris* of trees are allowed to lie and accumulate year after year, till they become so infested with vermin, insects, and fungoid organisms, as to threaten the very existence of the growing trees. Such matter is the origin of half of the diseases from which our forest trees suffer; and those who neglect its timely removal will certainly reap the reward of their neglect in vastly diminished profits from the deteriorated condition of the produce. Sickly, fallen, or decaying trees—in fact, all vegetable matter in a decaying state—are prolific sources of the fungoid diseases of trees, and also of many of the numerous tribes of insects which commit such deadly ravages upon healthy living plants. It is a common practice in thinning plantations to leave all the smaller branches and other refuse to rot on the ground, or, what is even worse, to roughly collect and pile it up into heaps for sheltering game. Scarcely anything could be worse, either for the plantations or the game, than these rotting heaps, swarming with all manner of insects and fungoid life. Living plants of gorse, privet, bramble, rhododendron, laurel, and other evergreens, produce far superior and healthier cover for game, so that there is the less excuse for the indolent plan and bad practice referred to. From this cause scarcely a season passes but we hear of serious damage to Scots fir plantations by the ravages of the Pine Beetle (*Hylurgus piniperda*), the eggs of the beetle being laid

under the bark of the recently felled trees, prunings, or thinnings which strew the ground. Fallen or dead trees, and their decaying roots, are also the ascertained breeding-places of that most destructive of insects to the fir tribe, the Pine Weevil *Hylobius abietis*), which inflicts such fatal injuries on young Scots fir plantations in many parts of the country. These are only two of many well-known injurious insects which are encouraged to multiply and extend their depredations by neglecting a periodical clearance of plantations from dead wood, upon which these and other injurious insects deposit their eggs and hibernate during the winter.

By taking the precaution to remove all such fallen wood from plantations at this period of the year, before the heat of spring and summer calls these insects into active life, multitudes of them are carried away and destroyed, and the few that may be left are so unseasonably disturbed that many of them die before they arrive at maturity; and consequently, the age of reproduction never being reached, they gradually become less and less numerous, until they become extinct altogether. If the contrary method of utterly neglecting these necessary precautions is followed, which we regret to say is by no means a rare occurrence, both insects and fungi increase and spread at an alarming rate, and in favourable seasons inflict most grievous injury upon the plants in the woods and plantations. In most instances severe outbreaks of insects, &c., can be directly traced to the neglect of some simple law of nature, by timely attention to which all the evil that has been committed might with the simplest means have been entirely prevented.

It is thus seen that even although the refuse and *débris* of plantations may not be saleable, or if it is the value may not pay the cost of collecting, still, to insure healthy crops of trees and the best quality of timber, it is really of the utmost importance that woods and plantations be gone over annually to clear them of all fallen timber and decaying refuse. If the produce of the clearing will not pay for removal, it ought to be gathered into heaps in safe and convenient places, and burnt on the spot, so as to get rid of it at the least cost, and prevent the occurrence of calamities of a far more expensive nature.

At a meeting of the Royal Horticultural Society of London on February 19, a very interesting collection was exhibited by Dr. Hogg, of the varieties of Birch, Hornbeam, and Hazel, which are found growing in the woods and plantations in the southern counties, especially in

Sussex, where these trees are probably more extensively cultivated than in any other part of the south of England. The specimens shown were the red and white varieties of the common Birch (*Betula alba*), the red and white Hornbeam (*Carpinus betulus*), and the red and white Hazel (*Corylus avellana*), all varieties well known to the woodmen of Sussex, but so far as known quite overlooked hitherto by botanists and the authors of works upon our forest trees. In the Weald of Sussex the white variety of the Hornbeam is known by the name of "Beech," and the red variety as the "Husbeech," the true beech being distinguished by the name of the "Timber Beech." The different varieties are easily distinguished by the initiated by their difference in habit, general appearance of foliage, colour of bark, &c., accompanied by differences in the colour and texture of the wood, which for practical purposes indicate important variations as to the degree of elasticity, brittleness, toughness, and endurance of the timber, and its usefulness for the various purposes for which it is applicable. The red varieties are generally of a harder grain and more unbending than the white, which are more pliable and tougher, and hence the woodmen select the sort best adapted for the purpose,—red hornbeam, for instance, never being used for "withes,"—because of its very brittle nature.

At the same meeting a diagram was shown by Dr. Masters, of the leading shoot of a plant of *Abies Nordmanniana*, which showed the line of revolution performed by it during the period of twelve hours as observed in July last. The movement was noted from hour to hour, the shoot sweeping round and keeping its point towards the east from 9 a.m. till 3 p.m., from which time till 7 p.m. it was directed vertically, at 8 p.m. the tip of the shoot pointed to the north, and at 9 p.m. to the north-west. Such phenomena are probably of more common occurrence amongst trees than has previously been suspected.

In our August number we had the pleasure of announcing the visit to Europe of the Hon. B. G. Northrop, of the Board of Education of the State of Connecticut, for the purpose of inspecting and collecting information concerning the modes of teaching and working followed in the various schools of rural industry on the Continent, especially in reference to Schools of Forestry and Forest Management, with a view to the results of his investigations and observations being laid before the people of the State, so as to instruct them in the best methods of reclamation of waste land, and the propagation and extensive planting of trees, especially for shade, shelter, use, and ornament, in the towns and villages of the State, and upon the bare treeless tracts of cultivated lands, from which the grand primeval forest has been clean swept

away. Mr. Northrop successfully accomplished his purpose last autumn, and made the most of his opportunities, considering the comparatively limited time he could afford for the investigation of such a ramified and wide-spread subject. Since his return to the United States he has been busy preparing a detailed report of his proceedings and observations, which he expects to be able to lay before the public in the course of the spring; but in the meantime he is giving lectures, during his spare intervals from duty, on "Recent Observations in Europe, especially in Forestry," to large and deeply interested audiences in Boston, New York, Baltimore, Philadelphia, Washington, and other large cities in the States. A Baltimore paper, in remarking upon a lecture recently delivered there by Mr. Northrop, says, "The address was very interesting and suggestive throughout, being full of the best practice pursued in Europe, skilfully adapted by the lecturer to the wants of our country, and was listened to with rapt attention by a large, refined, and intelligent audience, who fully appreciated the successful efforts made to entertain and instruct them at the same time."

Besides his more important duties and elaborate lectures on Forestry in the large cities, Mr. Northrop also finds time to deliver short lectures upon "Village Improvement" to his neighbours in the smaller towns and villages of the State of Connecticut. These lectures comprise a variety of topics of social and rural interest, but special prominence is given to the advantages to be derived from the extensive planting of ornamental trees for improving the amenity of private grounds and dwellings, public parks, streets, squares, walks, roads, &c., so as to afford healthy enjoyment and benefit to the whole community. This is a subject to which Mr. Northrop has given particular attention, and his labours in many towns and villages have resulted in permanent organizations, known as Village Improvement Associations, which are doing incalculable good by cultivating correct taste, inciting public spirit, and quickening social and intellectual life in the performance of those duties which the public authorities are too apt to neglect in older settled countries than the United States. We would like to see a similar spirit more freely developing itself amongst the inhabitants of the towns and villages in this country. The cultivation of a true taste for the beautiful in nature is a subject that requires much more attention than has hitherto been paid to it by our civic rulers, and we have much need of such an able and enthusiastic pioneer as Mr. Northrop to rouse up the denizens of our towns to a due appreciation of the wholesome benefits to be derived by a judicious and well-regulated outlay upon modern improvements, especially in the adornment of our streets and squares with properly selected and well-grown trees and shrubs of a really tasteful and ornamental character.

Cultural First Principles.

By G. S. BOULGER, F.L.S., F.G.S., late Professor of Natural History in the Agricultural College, Cirencester.

VII.—Flowers.

(*Continued from page* 677.)

The leaf is as important from the point of view of the "transcendental,' or comparative anatomist as we have seen it to be from that of the physiologist, or student of the life processes of the plant. It is so because it is the archetype of all the principal organs which constitute the flower and fruit. These organs are, in fact, simply leaves which have become modified for certain special functions. The *flower* consists, speaking generally, of several circles or "whorls" of leaves, which are concerned directly or indirectly with the reproduction of the plant by means of seed. These leaves are, therefore, often destitute of chlorophyll, or leaf green, and do not "fix" carbon from the atmosphere. Their respiration, or inhaling of oxygen and exhaling of carbonic acid, is consequently more easily observed than that of ordinary green foliage leaves.

What is said in this paper must be understood to apply solely to the flowers of what are commonly called "flowering plants"—the "Phanerogams" of the botanist—and not to the reproductive systems of the lower plants, fungi, seaweeds, mosses, and ferns. With the less easily observed structure of these latter—the "Cryptogams" of the botanist—no cultivators, save growers of mushrooms and ferns, need trouble themselves. There is also considerable difference between the reproductive organs of conifers and those of other flowering plants, which will be more fully alluded to later; the present sketch must be understood to treat of the latter—the "Angiosperms" of botanists, or those plants whose seeds are perfectly enclosed in a fruit. Let us take a few types, a buttercup, a white water-lily, a violet, a bunch of lime blossoms, a daisy, and a spike of foxglove to commence with. Under each blossom of the foxglove we see a plain, green leaf; while the stalk of the bunch of lime blossoms seems to spring from a broad, pale-coloured leaf-like organ. In the well-known greenhouse plants the Poinsettia and the Bougainvillea we find corresponding leaves round the small flowers, but here they are gaily coloured. Still their veins prove them leaves. Now the daisy blossom is a collection of numerous small flowers crowded together at the end of the flower-stalk; just as

if all the small white flowers of the carrot or the hemlock were deprived of the little radiating stalks, like the ribs of a Japanese umbrella, which give the name "umbel" to this form of flower-grouping or 'inflorescence." The inflorescence of the daisy is called a "head," and we see underneath it a number of overlapping green organs, similar to those at the point where all the little flower-stalks of the carrot or hemlock meet. Halfway up the flower-stalk of the violet we may see two small similar leaflets. All these organs are called *bracts*.

Under the yellow part of the buttercup, outside the white of the water-lily, and in a corresponding place in violets and foxglove, is a single circle of small green organs like the bracts of the daisy. These are *sepals*, collecting the *calyx*. A collection of bracts as in daisies and dandelions is termed an *involucre*. In the fuchsia the calyx is coloured. Though seldom so clearly veined as bracts often are, the sepals are broad, mostly green, and altogether not unlike leaves. In the water-lily the sepals are white on the inside, and within them are similar organs faintly streaked with green outside, or purely white. These are the *petals*, termed collectively the *corolla*. In the buttercup they are yellow, in the foxglove they are red, and are united into a tube. There are five sepals and five petals in a buttercup, and four of each in the flower of charlock, and these two numbers or their multiples are characteristic of nearly all of a large division of Angiosperms—those, namely, which have two leaves, or *cotyledons*, to the seed, and are therefore called *dicotyledons*, have generally tap roots, separable bark, wood in wedge-shaped bundles increasing by rings, true pith, and net-veined leaves. All our forest trees—except the conifers—belong to this group. But if we look at the flower of a true lily, or a single tulip, or hyacinth, we shall see six floral leaves alike coloured in place of the calyx and corolla. This is called a *perianth*, and when composed of three leaves or some multiple of that number is distinctive of the other great group of Angiosperms—the *monocotyledons*. These have only one cotyledon, do not have tap roots, separable bark, or wood in rings, and their leaves have parallel veins. The lilies, palms, and grasses are the three main subdivisions of this group.

The perianth or the calyx and corolla are called floral envelopes, since one of their main functions is to protect the inner and more essential parts of the flower; but when coloured, scented, or secreting honey, these envelopes serve the additional function of attracting insects, which bring about cross-fertilization.

Some of the inner petals of the water-lily may be seen slightly narrower, and bearing on the upper part of their inner surfaces yellow pouches, or these pouches may be seen, as in the buttercup and foxglove, at the top of a slender stalk or *filament*. The pouches are called *anthers*, and contain a fine dust well known as *pollen*. Anther and

filament together form a *stamen*, and, as they are the male organs of the flower, all the stamens together are termed the *andrœcium*. Though it is not so apparent, monstrosities and other evidences prove each stamen to be a modified leaf. The anthers vary in colour and in the way they open to discharge the pollen, and this latter is also different in different species in colour, size, and form, as is seen under the microscope.

In the centre of he flower of the buttercup are a number of green ovoid organs collected in a head. These are called *carpels;* collectively, the *pistil.* Each carpel here contains one *ovule* or immature seed. In the water-lily we have numerous carpels united in a capsule, and each containing many ovules. In the foxglove we have two, and in the tulip three united carpels, each containing many ovules. In these two last-mentioned types the pistil is prolonged into an erect pillar-like tube, which is called a *style*, and is surmounted by a sticky knob called the *stigma.* This sticky surface is present at the apex of each little carpel in the buttercup, and on the top of the capsule of the water-lily. The lower, hollow part of the pistil, containing the young seed or ovule, is called the *ovary.* In the pea we have an ovary of one carpel with several seeds, which afterwards becomes the pod, and in the old-fashioned bladder senna (*Colutea*) we can see still more plainly that a carpel—like a petal or a stamen—is only a modified leaf.

Each pollen-grain has two coats, of which the outer is generally perforated in some way. When carried by wind or insects, it falls on the sticky stigma, by the physical process once before alluded to, known as *osmose;* the inner coat is protruded, like the finger of a glove, through the perforations of the outer, and grows down the tube of the style into the cavity of the ovary, and into a little opening at the top of an ovule, to be described hereafter. This is fertilization. Thus the pistil is the female, as the stamen is the male organ, and, from the importance of their function, they are termed the *essential organs* of the flower. Such being the typical structure of the flower, let us trace its relation to that of some of our forest trees.

In the lime *(Tilia)* both calyx and corolla are green, as also in the spindle tree *(Euonymus Europæus)*, buckthorn *(Rhamnus)*, maple *(Acer campestre)*, and sycamore *(Acer pseudo-platanus).* In the elm *(Ulmus)*, we have little clusters of flowers, with a green calyx and no corolla. In the birch *(Betula alba)*, the alder *(Alnus glutinosa)*, the plane *(Platanus)*, the box *(Buxus)*, the walnut *(Juglans regia)*, the oak *(Quercus)*, the chestnut *(Castanea)*, the beech *(Fagus sylvatica)*, the hazel *(Corylus avellana)*, and the hornbeam *(Carpinus betulus)*, some flowers have stamens and no ovary, others ovary and no stamens, both kinds occurring on the same tree. Such plants are termed *monœciously diclinous.* The willow *(Salix)* and poplar *(Populus)*, have the male

and female blossoms on different trees, and are therefore termed *dioeciously diclinous.*

The flowers of the birch and alder are in catkins, each of which is wholly made up of flowers of one sex. The male catkins are generally the longer, and fall off after shedding their pollen, whilst the female ones persist till the ripening of the fruit, forming in the alder a woody cone-like body. The floral envelopes are reduced to one or two scales to each flower.

In the plane the envelopes are similarly reduced, and the flowers form globular heads, two or three of which hang on a pendulous branch. Those on one branch are all of one sex, and the male branches drop off like the catkins of birch and alder.

The flowers of the box occur, male and female together, at the junction of the leaves with the stem—the *axil,* as it is termed. They have from four to twelve green sepals.

In the walnut the male flowers are in catkins hanging from the axil. The green perianth has generally six leaves, and the numerous large anthers have hardly any filament. The female flowers are far fewer, and are grouped in erect clusters of five or six, in axils. They have an outer circle of six sepal-like bracts, commonly called an involucre or *cupule,* and four larger inner floral leaves, called the corolla, two of which are prominently larger.

In the oak the male flowers occur at intervals along a pendulous catkin, and have generally six minute sepals. The female flowers are solitary on an erect stalk, and have a three-styled ovary, a 3—8 lobed calyx and an involucre of numerous overlapping bracts, which afterwards forms the "cup" of the acorn, and is therefore called the *cupule.* There are two varieties of our British oak *(Quercus robur);* one having stalked leaves, but very short stalks to the acorn-bearing (female) flowers, called therefore *sessiliflora;* the other having no leaf stalks and long flower-stalks, called *pedunculata.* On these I would quote the following from Mr. Laslett's "Timber and Timber Trees":—

"It is the prevailing opinion that the wood of *Q. robur pedunculata* is the best in quality. I have not been able to discover any important difference between the two. Few surveyors are able to speak positively as to the identity of either. The timber of the *sessiliflora* is a little less dense and compact in texture. It is fortunate that the *pedunculata* is to be found in greater abundance; and it is greatly to be desired that, in any future planting, care should be taken to perpetuate it, although, as a commercial speculation, the *sessiliflora* would probably yield the best return, as it generally attains a greater length of clear stem. Very fine specimens of the *sessiliflora* are to be met with in abundance in the Forest of Dean, where, upon a rocky subsoil, the oak trees generally attain noble dimensions, with, however, this drawback—they

are liable to the cup and the star-shake. I incline to the belief that these defects are less frequent in the *pedunculata*, whatever the situation or soil may be upon which they are grown."

In the Spanish chestnut both male and female flowers occur on similar catkins. The female occur two or three in a cluster surrounded by an involucre of bracts, from the axils of which grow the spiny abortive branchlets, which afterwards surround the fruit.

In the beech the male catkin is globular and long-stalked, whilst from one to three female flowers are enclosed by the involucre of four bracts, which afterwards becomes brown and hard, enclosing the "mast" or fruit.

The long, greenish-yellow staminate catkins of the hazel are well known. The female flowers have red styles, and occur surrounded by bracts, forming small oval bodies, in the axils. The bracts afterwards form the green husk of the nut. The perianth is absent in this tree and the hornbeam. The male catkin of this latter species resembles that of the hazel, but has larger bracts; the female flowers are also in a pendulous catkin, occurring in pairs in the axils of green bracts which grow into three-lobed leaf-like appendages to the fruit. The stamens of the hornbeam, with a forked filament, are worthy of examination.

In the willows the male trees bear the beautiful globular, golden-anthered catkins, known as "palm;" the female catkins are longer, of a greyish appearance, with silky bracts and ovaries. The male catkins of the poplars are long and pendulous.

It only remains to notice the Coniferæ, the principal types of which are the yew *(Taxus baccata)* and gingko or maidenhair tree *(Salisburia adiantifolia)*, the pines, larches, and cedars *(Pinus, Larix, Abies, Cedrus)*, the mammoth tree *(Sequoia* or *Wellingtonia)*, and the cypresses, junipers, and arbor-vitæ *(Cupressus, Juniperus, Thuja)*. These are types of the *Gymnospermia*, or naked-seeded plants, those which have no closed ovary. They have no true perianth or floral envelopes, and are all diclinous. The yew and the gingko are diœciously diclinous; they have large clustered stamens, surrounded generally with scale-like bracts in the axils of the leaves, and solitary ovules gradually surrounded by a fleshy disk or cup, which in the yew is pink and remains open, having a drop of fluid in its mouth in lieu of stigma, but in the gingko almost closes over the ovule. Round its base is an involucre of green bracts.

In the true cone-bearers the male catkins are simply masses of anthers on small scales, containing enormous quantities of a very minute pollen. The *cone* is an organ the nature of which is still disputed, but it consists essentially of a number of overlapping scales that bear naked ovules on their inner surface, at the base in *pinus*, at the

centre in *sequoia*. These scales subsequently become woody. The male catkins of the cypress, juniper, and thuja resemble those of the yew, whilst the female cones, or *galbuli*, only differ from those of *pinus* in having few scales, which do not overlap and become rather fleshy than woody.

Allusion may be made hereafter to the importance of the deciduous floral organs as manure; but the only justification that can be given for the present array of structural details, is their necessity to an understanding of the life history of our forest trees, and the necessity that sound practice should be based on such an understanding of sound theory.

THE RIGHT OF "PANNAGE."

In the case of Chilton v. Mayor of London, which was tried before the Master of the Rolls on Feb. 8, the plaintiff, a commoner of the manor of Loughton, part of Epping Forest, sought to restrain the defendants, the Mayor and Corporation of the City of London, the lords of the manor, from (*inter alia*) lopping oaks and pollards so as to interfere with the plaintiff's right of "pannage." The right claimed by the plaintiff is for his pigs to eat the acorns and beech mast falling from the trees of the woods on the manor. It was contended that the defendants had no right either to cut down the oak trees or to lop the pollards so as to diminish the quantity of acorns otherwise falling to the ground. The defendants, on the other hand, contended that the plaintiff was only entitled as a subsidiary right to such acorns as happened to be on the ground, and that they could lop or cut down their oak trees in a usual course of husbandry.

Mr. Davey, Q.C., and Mr. Elton appeared for the plaintiff; Sir J. Stephen, Q.C., Mr. Chitty, Q.C., and Mr. W. R. Fisher for the defendants.

The Master of the Rolls knew of very little authority on the point, and the industry of counsel had not been able to furnish him with any decided case, and, in fact, there seemed to have been a singular absence of litigation as to this right of "pannage." All the dictionaries were agreed that it was simply a right to go into another man's wood, and allow pigs to eat the acorns or beech mast which fell on the ground. The drovers of the pigs had no right to take the acorns off the trees or even to shake them. How did this right affect the granters of the "pannage"? From the time of Richard I. to the present day he had never heard of any interference with their right to cut the trees when ripe for so doing, or to lop the pollards in the ordinary course of husbandry. He came to the conclusion, therefore, that the plaintiff had not the right claimed, and it was not necessary to consider whether he had suffered any injury. His lordship then proceeded to consider some other grounds for the injunction asked for, which are not necessary to mention, and, eventually, refused to grant the same, and dismissed the motion, with costs.

The Construction and Maintenance of Roads.

By ALFRED J. BURROWS, Pluckley, Kent.

(*Continued from page* 620.)

The entire subject of road-making and maintenance is one of such great importance that some remarks upon the theory may not be out of place, especially as recent experiments and practice have done so much to dispel old ideas, and establish new ones based on science.

As distances are measured by units of length,—the inch, foot, or yard,—capacity by gallons, bushels, or chaldrons,—weight by ounces, pounds, or tons,—so the unit of work of the engineer is the force required to lift one pound in weight through one foot of space. By elaborate calculations Watt fixed the power of a horse at 33,000 units of work per minute, though later calculations place it much lower, and consider 22,000 a fair average. Still the former figures are adopted by engineers in fixing the horse-power of their engines.

The force necessary to move a load is due partly to the resistance of friction and partly to gravity. Friction diminishes in proportion to the smoothness and rigidity of a road: thus the force necessary to move one ton upon the metals of a railway is about $\frac{1}{280}$th part of its weight, or eight pounds; whereas to move the same load upon the best macadamized road requires a pressure of about $\frac{1}{30}$th, or 74 pounds. The force required in each case is called the traction, and the fraction by which it is expressed, its co-efficient of friction.

In calculating the power of a horse to move a load upon a rising road, to the resistance of friction must be added the work necessary to overcome gravity. Supposing the rise of the road to be 1 in 20; for every 20 feet travelled by the horse he will lift the entire load to the height of one foot, or have performed 2,240 extra units of work—equal to 112 units for every foot run. To perform his quota of work according to the theory of Watt, the horse must draw his load upon the level at the rate of 446 feet per minute, or proceed at the rate of a mile in 11 minutes; while upon the road having an incline of 1 in 20 he would require to proceed only at the rate of 117 feet per minute, or a mile in about 30 minutes.

As a somewhat exaggerated illustration of the unnecessary expenditure of power in dragging loads up steep hills, let the reader take a

moderately oval pear, and cut it in half longitudinally, afterwards placing one-half with its cut surface flat upon the table. After marking points equidistant from its two ends, let him measure a line across its centre, and another from the two central points around its end, on a level with the table. The latter line will not exceed the former by more than $\frac{1}{4}$. Apply the illustration to the case of a steep though surmountable hill. In the one case of crossing, the work in overcoming gravity is very great; whereas in the other it is reduced to a minimum.

Since good roads are of primary importance to owners as well as occupiers of land, their construction and maintenance should receive more enlightened attention. The Highway Act has modified the practice, and partially reformed the whole system of surveyorship. Under the old method of parish apprenticeship to road-making, each large ratepayer was in turn elected to the office, took over the books and the balance in hand or deficit, as it might be, roughly coated from the nearest stone-hole the highways in his own neighbourhood, attended another parish meeting to audit his accounts, and bequeathed his mantle to his successor. Thus as soon as he had obtained a little insight into his work he was superseded.

As at present constituted, Highway Boards consist largely of tenant-farmers, whose interests in the roads are co-existent only with their period of tenancy, and who therefore grudgingly vote the money required to maintain those roads in a passable state. Under such circumstances extensive permanent improvements are out of the question. The only way to grapple with the difficulty in neglected districts would be for landlords to take the roads in their own hands, and either by their own outlay or by money borrowed, subject to repayment in 20 years, straighten, drain, culvert, and thoroughly repair them, and then recoup themselves by a slightly increased rent. Local taxes upon carriages, &c., should then be devoted to road purposes; and traction-engines, in particular, should be taxed in proportion to their weight and the load they draw.

Doubtless circumstances have greatly changed since 1811; but the evidence of Mr. McAdam, given before a committee of road commissioners, led to their embodying in their report a remark to the effect that the saving to the country by putting the roads in a proper state of repair would be £5,000,000 annually. But for the expense of collection, and the opportunities afforded for peculation, the payment of tolls is, after all, the most equable system of road maintenance.

Though the nearer the line of road approaches the level the less will be the actual draught, still it is doubtful whether a horse does not travel with more ease upon a road which has occasional slight inclinations; as the shifting of the load, and the consequent alteration of the line of draught, afford temporary relief. Moreover, where much dirt

is allowed to remain upon the surface, every passing vehicle aids the removal of water by forming longitudinal channels which help to carry it off.

Where too great a convexity is given to the surface of the road, the centre, being the safest part of the course, and the only one in which a vehicle stands quite upright, is chosen by every driver. Consequently, the wear of the surface is uneven, and the cost of maintenance is increased. Besides, upon a surface too much rounded the tendency of the load is to force the carriage down the inclined plane: thus the road and the carriage wheels are more worn, and the labour of the horse considerably increased.

One great mistake in road-making is laying on too thick a coat of metal at one time. As a rule more than three inches is objectionable, for a greater thickness remains so long loose that its strength is greatly reduced before it settles down and binds.

The size of wheels is a subject which also demands attention, for while the resistance of traction in a load is in direct proportion to the load itself, it is inversely proportioned to the diameter of the wheel. Upon a well-formed road with smooth surface there is no advantage in increasing the width of tyre beyond 3½ inches, as above this point the resistance is independent of width. Much greater damage is caused to roads by small wheels than by large ones, and by carts without springs than by springed vehicles.

In laying out roads of any kind a contour map of the district will be of the greatest service, as a glance at it will enable the surveyor or road-maker to choose his line of road, so as to avoid extremes of inclination. Such a map may easily be laid down by any one tolerably acquainted with the use of the theodolite.

Elaborate experiments by M. Morin and Sir John Macneil have cast much light upon the theory of road-making. Upon macadamized and paved roads traction increases with velocity when the latter is above 2¼ miles per hour; while upon roads of turf, sand, loose earth, or newly-laid thick gravel, it is independent of speed. Upon a compact pavement of stones, when the pace is slow, the traction is but ¾ of what it is upon the best class of macadamized roads, while at a round trot resistances are equal. As an illustration of the advantages of a firm bottom, the following data are quoted from Sir John Macneil. Tractive force to draw one ton on the level:—

1. Well-made pavement, equal to 31 lbs.

2. Road formed of six inches of broken stone, laid on a solid foundation of large stones, or on concrete, equal to 44 lbs.

3. Flint road, or road of thick broken stone laid on earth, equal to 62 lbs.

4. Thick coating of gravel on earth, equal to 140 lbs.

Wherever this is possible the gradient of a road should not exceed 1 in 40. As the gradient increases, the cost of maintenance also becomes greater. The brakes, slides, or skidpans put on in descending slopes cause great abrasion of the surface; and the efforts of the horses to obtain a firm footing where the ascent is steep cause a considerable excavation of the surface at every step.

Experiments by Mr. Mitchell show that when a cubic yard of stone is broken into road-metal of about $2\frac{1}{4}$ inches, and laid on to a thickness of six inches, it contains about 11 cubic feet of interspaces. And as a well rolled road-covering contains only from 20 to 30 per cent. of such interspace, and must therefore consist of from 70 to 80 per cent. of solid stone, the great advantage of the latter in point of solidity is at once apparent. The diminution of bulk by efficient steam-rolli g reduces the interspaces one-half.

Moderately wide roads are much more durable than very narrow ones, where every vehicle has to follow in the same track; and as their surface is so much drier the draught upon them is proportionally decreased. In our northern latitudes it is very essential to have the hedge on the south side of the road as low as possible, in order to insure the full benefit of the sun's rays.

A series of experiments by M. Dupuit, upon macadamized roads only, enabled him to arrive at the following conclusions:—

1. The resistance to traction is directly proportioned to the load.
2. It is independent of the width of tyre.
3. It is inversely to the square root of the diameter of the wheel.
4. It is independent of the speed.

Experiments made in the north of France, where powerful Flemish horses are used, show that the average daily work of such horses is to draw 25 tons over one mile of macadamized road. At the same time it was proved that the work performed per hour in winter upon paved roads was greater than that done in summer upon the macadamized. Statistics collected at the same time proved that horses in regular work lasted a much shorter time upon the macadamized roads than upon the pavement. Waggons wore out in the proportion of 7 years to 9, and harness as 5 to 6 years.

Trivial as these details may appear, when we consider the total amount of money invested in horses, harness, and carriages of various kinds throughout the country, the subject of road-making, and the importance of securing the smallest possible amount of wear and tear, demand greater attention than has hitherto been bestowed upon them.

In country places no available data are at hand, upon which to base reliable calculations. But it has been computed that within a circle of $4\frac{1}{2}$ miles from Charing-cross about £4,000,000 sterling is invested in horses, carriages of all kinds, and harness. This estimate does

not include saddle-horses. When we consider the enormous amount of money invested throughout the country, and estimate the saving in horseflesh, harness, and vehicles, which would result from good roads, independently of the saving in the maintenance of the roads themselves, we shall come to the conclusion that the subject is one of vital importance to the community at large.

The subject of road-rolling has been alluded to in a former paper. Doubtless a considerable saving in the expenses of road-maintenance may be effected by rolling well the surface of a new road before throwing it open to ordinary traffic. By the passage of narrow wheels over a bed of loose stone, the broken stone is forced irregularly into the subsoil, unless the road is well paved; and it will probably be necessary to lay on 9 or 10 inches of metal in order to obtain a permanent coating of 6 inches. By using a heavy roller of 3 or 4 feet wide, which carries the whole mass down together, the same thickness of coating may be obtained by laying on 8 inches.

In the "Report on the Economy of Road Maintenance and Horse-draft through Steam Road-rolling," by F. A. Paget, C.E., which was printed by order of the Metropolitan Board of Works, it is stated that the French, "after nearly ten years' experience in Paris, consider that they save 50 per cent. in maintenance, over and above the expenses of rolling."

GIGANTIC AMERICAN TREES.

At the Great International Exhibition, held at Philadelphia, in 1876, there were exhibited some extraordinarily large sections of various species of trees, from California and Oregon, amongst which, besides the *Sequoia gigantea*, or *Wellingtonia*, with the dimensions of which we are already familiar, there were several notable examples of gigantic growth. Two sections of the Oregon Yellow Pine (*Abies grandis*) were exhibited, which were cut from a tree 321 feet in height and 15 feet 9 inches in diameter at the butt. The first section was taken at the height of 130 feet from the ground, and measured 6 feet 10½ inches in diameter, exclusive of the bark. The second section, taken at 200 feet up, measured 5 feet 10 inches in diameter of solid timber. A fine section from the same State of *Abies Menziesii*, taken at the height of 98 feet from the ground, was 6 feet 10 inches in diameter, and the tree from which it had been cut was stated to have been 318 feet in height and 16 feet in diameter at the butt. A magnificent section was also exhibited of the Oregon Red Cedar (*Thuja gigantea*), which measured 22 feet in diameter, and was taken from the base of a tree said to have reached the gigantic height of 325 feet.

Opinions of Continental Foresters, and Professors of Forest Science, on the Location of a School of Forestry.

By JOHN C. BROWN, LL.D., Haddington.

In the spring of 1877 I published a pamphlet entitled, "The Schools of Forestry in Europe: a Plea for the Creation of a School of Forestry in connection with the Arboretum at Edinburgh." *

Two objections to such a measure have been advanced: the first is that the expense would be very great; the second, that the locality is unsuitable.

In connection with the first of these objections I would submit for consideration that it has lately been stated authoritatively, with regard to the salaries attached to professorships in the University of Edinburgh, that the average salary of the chairs of this class in the Faculty of Arts is only £280 a year; in the Faculty of Law, £176; and in the Faculty of Medicine, £120. One chair has no salary. In the Faculty of Divinity the salaries are, on the average, larger than in the other Faculties; but the class fees are small, and the field from which students are drawn is limited.

In connection with the second objection I would submit for consideration the opinions in favour of and against substituting for isolated professional schools of forestry, professorships of forestry in universities and other educational institutions of a more comprehensive character, expressed at the Congress of German Foresters, held in the autumn of 1874 at Freiburg, in the Breisgau, in the Grand Duchy of Baden, at which this subject was fully discussed.

It was the third congress which had been held in Germany, and it was numerously attended, more numerously than either of the preceding meetings. The members of the congress were from all parts of Germany, and from countries adjacent: 134 were from Baden; 55 from Bavaria; 55 from Prussia; 41 from Wurtemburg; 35 from Alsace-Lorraine; 21 from the Central German states; 15 from Hesse: and there were besides 18 from Switzerland, 3 from Austria, and 1 from Russia:—378 in all. In that number were 23 members who were not professional foresters; a large proportion of the authors

* Edinburgh: Oliver and Boyd, 1877.

of German works on forestry were there, and many Government officials entrusted with the administration of forest management in Prussia, Bavaria, Wurtemburg, Hesse, and Baden.

The president chosen was Dr. Nordlinger, *Forstrath* and Professor of Forestry at Hohenheim.

Four subjects had been proposed and adopted for discussion.* The first of these was that above referred to, and was stated thus, "*Forstakademie oder allgemeine Hochschule?*" Forest Academy is the name given to isolated educational institutions designed exclusively for the study of forest science and forestry. *Allgemeine Hochschule* is the comprehensive designation given to colleges in which provision is made for a much more extensive and comprehensive course of study being followed, if desired, while attendance may be confined to specified classes if this be required or preferred.

Such *Allgemeine Hochschulen* are the following:—The Royal Academy of Land and Forest Economy at Hohenheim in Bavaria, in which there are three distinct departments of study:—1. *Landwirthschaft*, or Rural Economy, inclusive of agriculture, horticulture, cattle breeding, &c. 2. *Forstwirthschaft*, or Forest Economy in all its departments; and 3. *Grund-und-Hilfs-Wissenshaften*, or sciences on which these are based, and sciences by which they may be advanced, including mathematics, physical science, technical arts, political economy, and jurisprudence. For the teaching of all of these there is provided a staff of professors, &c., with all necessary appliances. The Polytechnic School at Carlsruhe, in the Grand Duchy of Baden, in which there is embodied—1. A school of mathematics. 2. A school of engineering. 3. A school of machinery. 4. A school of architecture. 5. A school of forestry. For the teaching of all which there is provided a staff of forty-nine professors, lecturers, college tutors, and assistants, with all necessary appliances. And the designation is susceptible of such distention as to include universities.

The interest created by this discussion was great and wide-spread. Both official† and private reports of it were published.

For the following details I am indebted to an account of the Congress furnished by Herr J. Lehr to the *Allgemeine Forst- und Jagd-Zeitung*, edited by Professor Dr. Gustav Heyer, Director of the Forest Academy of Münden, in Hanover, and Privy Councillor of the kingdom of Prussia.

The question gave occasion for a discussion occupying six hours, which was conducted with ability, and listened to throughout with

* But two only could be overtaken, though the session extended over three days.

† Bericht uber die III. Versammlung deutscher Forstmänner zu Freiburg i. B. Vom I. bis 5. September, 1874, pp. 212 8vo. Berlin, 1875. Verlag von Julius Springer.

marked attention, the sederunt, commencing at 8 a.m., being continued with an hour's interval till three o'clock in the afternoon. It appears to have been a continuation or resumption of a discussion of the same subject at Mühlhausen the year before. Two distinguished students of forest science had been appointed to open the discussion by reading papers, each stating the case in favour of that one of the arrangements which he approved.

The discussion was opened by Ober-forst meister Professor Danckelmann, Director of the School of Forestry at Neustadt-Eberswalde, in Prussia, defending the organization of Forest Academies in preference to the substitution for these of arrangements for the study of forest science in universities or other seats of learning. In the opening of his address he alleged that the movement in favour of this latter arrangement had not originated with the Governments, or the Legislative Assemblies, or the forest officials of the day, but with professors in universities, and others ambitious of attaining to the status and emoluments of such, desirous of elevating the position of forest science amongst other departments of science; but he intimated that all this he considered unnecessary. He contrasted the progress made by the school of forestry at Münden, in Hanover, contrary to predictions which had been freely made, with an alleged failure of the *Hochschule für Bodenkultur* at Vienna, which he described as an extra-mural member of the university without any basis of fundamental science, a school existing only on paper,—an incomplete piece of work, with little prospect of durability.

But against this representation Dr. von Seckendorf, from Vienna, who was the member of congress appointed to open the discussion by stating the case in favour of arrangements being made for the study of forestry at *Hochschulen* and universities, protested.

Herr Danckelmann went on to say that, the ground having been prepared by pamphlets and articles upon the subject in journals the question was at length formally raised, I presume at the congress of the preceding year, held at Mühlhausen, when, with the solitary exception of Neustadt, which with the unanimous consent and agreement of his colleagues declared for the maintenance of forest academies, all seemed to support the movement.

In the meantime, in Bavaria, he said, a commission with a preponderating proportion of professors had spoken out against the maintenance of forest academies as separate institutions. But the Legislative Chamber took a different view of what was desirable, notwithstanding that the Government Board had also spoken in terms which could not be misunderstood in favour of the change. And he hoped for a vote of this congress which would keep the matter on the right rail. The question had been discussed at Mühlshausen, but the

advocates for a change had, he alleged, through fear of an adverse vote, moved the arena to Freiburg as a more likely place at which to obtain a decision of the question in accordance with their views. And yet it appears, from the account given by Herr Lehr, that more than three-fourths of the Prussian forest officials present at this Freiburg congress voted in favour of a university education in forest science and forestry.

The speaker stated his views of the functions of a university in education; which were that universities were organized on the principle of freedom of thought and speech, and were primarily designed for the thorough treatment of subjects of study in the abstract rather than in the concrete. They might be rich fountains of knowledge, but they did not pretend to teach practical skill. But the forest academies, on the contrary, kept the practical ever in sight; the prosecution of research was directed in accordance with forest science, and knowledge was combined with practice. There were four things to be desired: first, instruction in the technical work of forestry; next, instruction in the administrative management of forests; next to this, in scientific research; and lastly, in the practical application of established theory. Whatever would best secure all of these was the best arrangement possible, and he indicated his opinion to be that it was by means of special schools of forestry that this would be done.

Referring to the preference of the Bavarian Commission for the study of forest science and of forestry in connection with a *Hochschule*, he alleged that most of the *Hochschulen* were located far from any forest, and the professors were not necessarily men acquainted with forests, and the result might be, the students might come to know many things but to know no one thing thoroughly.

Referring to the compulsory study of practical chemistry at Carlsruhe, and to similar arrangements in other institutions, he said it could lead only to confusion. The students would remain strangers to forests; they would not learn how to question trees; they would see, indeed, cases filled with dead insects, but they would learn nothing of the lives of insects. Even the university professor in the forest would be little better than a blind man.

The assailants of forest academies attach little value to the vicinity of a forest, he said, but much to railway excursions. One considers any locality suitable if it be near a railway junction; another speaks disparagingly even of excursions as *Waldbummeleien*, or sauntering strolls in a forest. If we would make the forest a means of instruction, it should be simply and solely a demonstration ground, and the forest *Revier*—or forest division—solely an experiment *Revier;* and it should be so situated that it can be visited daily without fatigue and without expense. If these conditions be not secured, then is the

certainty of the end being gained lost. And it follows that the bes instruction in forest science and in forestry is to be obtained, not in a university, but in the forest academy. Be it the case that the university is the central meeting-place of intellectual aristocracy, and the *Hochschule* the place in which administrative culture is obtained, they are even then, each of them, but of secondary importance in the training in forest technology.

It is said that the forest academies, leaving out of their view general education, have never produced men of powerful thought and reasoning; while at the university the students drink from a pure fountain of the very well-spring of science. If it be the case that academies are open to this charge, the remedy is to be found in the academy and in the forest, with opportunity for the student to resort to the latter every day, where he can propose and solve his questions on physiology and zoology, and the forest student will thus walk side by side with the student of nature. The education advocated by the Bavarian Commission would produce very different results from what might thus be obtained. The teachers of the fundamental and accessory sciences would remain devoid of all sympathy with the forest, and would busy themselves with the solution of problems irrespective of their relation to forest science, and the result would be, the researches would have very much of a one-sided character. He said it might be alleged against him that these were only opinions of his, but that facts were against him. On the other hand, Herr Berr, the Minister of State, had himself declared that thus far the school of forestry in Aschaffenburg had done good service, and succeeded well. Von Mantel has given expression to a similar opinion. And in Prussia it is matter of experience that the professional school of forestry has produced more skilful foresters and district conservators and business men than have the small universities with which forestal instruction has been combined.

In reference to an allegation that forests in Hesse produced a net revenue of 21½ marks per hectare, and in Baden one of 24 marks, both being states in which forest officials were educated at schools of forestry in connection with *Hochschulen*—in the former the University of Giessen, in the latter the Polytechnicum of Carlsruhe—while in Bavaria, where they were educated at a forest academy, the forests produced only a net revenue of 19 marks, he showed that the arguments must, in the absence of information on many points, go for nothing; and he summed up in favour of maintaining the forest academies as special institutions, located irrespective of the *Hochschule* and the university.

The second speaker appointed to open the discussion was Dr. von Seckendorff, from Austria, Professor and Councillor of State, who

spoke in support of the proposal to combine schools of forestry with *Hochschulen* in which other studies were prosecuted, and stated, in reference to the allegation which had been made, that the movement had originated entirely with professors and candidates for professors' chairs, and not with practical foresters, or forest administrators; that the opinion held by him he had found shared by numerous forest officials with whom he had been brought into contact in other lands, and more especially by those of them who had studied at forest academies, a very great majority of whom had spoken of a combination of schools of forestry with the *Hochschulen* as a thing demanded by the honourable standing of forest science and of the forest service.

(*To be continued.*)

PICEA NOBILIS SEEDLINGS.

To a question asked by your correspondent Mr. Walton in reference to seed of this Conifer having been grown in open air without protection, I can state that when sojourning in South Devon my usual practice was to sow seed of *Abies Douglasii*, *A. nobilis*, &c., in sandy soil properly prepared in spring, making drills 2½ in. deep and a foot apart, the seed being sown in the same way that peas are sown and in equally exposed places. In due course the seed germinated, and thousands of seedlings appeared. The only after-care for the first year was keeping the ground clear of weeds. In the second spring, if the plants have made satisfactory progress, have them all very carefully lifted and replanted in good sandy soil about 6 in. apart and 15 inches from row to row. If skilfully managed many of them will be fit for removal to permanent positions in the third year after sowing. Take precaution that rats or mice do not eat the seed, which they will do if hungry. A sprinkling of powdered resin or red lead on the seed after it is slightly moistened will act as a deterrent. A very slight application of paraffin oil will also answer the same purpose. Where seeds of Coniferæ are not plentiful the better way will be to sow in shallow boxes well drained, and in prepared soil, placing them in a cold frame or pit near the glass, carefully attending to the soil being kept in a proper state of moisture.

In closing, will any of your correspondents inform me if they have raised *Wellingtonia gigantea* from home-saved seed? An answer in the affirmative, adding how it has been accomplished, will be interesting to your numerous subscribers, and also to—ROBERT BEGBIE, in "*Journal of Horticulture.*"

Deep Cultivation, its Effects on the Soil, Mechanically and Chemically.

By ALEX. JEMMETT, Murrell Hill Farm, Binfield, Bracknell, Berks.

With so wide a range and varied description of soil to tax the energy and intelligence of the agriculturist, there would at first sight seem but little hope that this subject could, with practical advantage, be dealt with within the scope of a necessarily circumscribed and short paper. However, casting aside whatever disadvantages may present themselves, we may enumerate a few at least of the advantages within our reach, by means of thorough and deep culture. It is incomprehensible that farmers—at least a very large majority—will content themselves with cultivating their land to only a few inches in depth, ignoring that storehouse of plant food lying within their grasp, below the upper stratum or layer of the soil, requiring but deeper manipulation to convert, with the aid of atmospheric influences—air and moisture—its available though pent-up substances into food congenial to the production of vegetable life. Seldom can any well-defined reason be given, but that, should the subsoil be interfered with to any appreciable depth, the crop will be injured, regardless that, by deep and thorough moving, the earth is made more porous and friable, which practical experience has proven tends to increase its productiveness. It is not on the experience of the present race of tillers of the soil, notably gardeners and nurserymen, only that we may rely for evidence of the usefulness—nay, necessity—of deeply moved ground, for the historical pages of past centuries can be quoted to strengthen and support our opinion and practice. The natives of the Celestial Empire have for many centuries past brought wonderful skill to bear on all the essential points of agriculture. The Romans for ages before the Christian era laid great stress on the efficient cultivation of the soil; one of their notable men, Columella, mentions that "the Romans tilled their ground two feet deep." "Superfluous moisture must be drawn off by ditches," writes the same authority, and this is most essential, indeed a *sine quâ non*, before deep cultivation can be brought into request with any hope of success. But as this subject—drainage—has been most exhaustively and judiciously treated on in your pages (678), we need not further allude to it, beyond the hope that your readers will study that excellent paper, previous to any step being taken in deep

culture. Likewise it must be borne in mind that whatever mechanical appliances may be used—horse or steam power—for bringing the soil into a proper tilth, it is necessary and essential to success that a favourable and fitting time be chosen for their use, for on this the benefit derivable from the various operations of tillage mainly depends.

The hope may be expressed that the physical properties of the soil, as compared with its chemical composition, are now more firmly fixed in the minds of the cultivator, ever reminding him of their close alliance and intimate connection. The soil must no longer be looked upon as "mere dead matter," returning no more than which is put in or added to it, but the agricultural mind must dwell upon and recognise the various constituents of which it is composed, only requiring in a majority of instances to be converted, by well-timed manipulation, into active agents for the production of plant life. This would strongly urge the necessity that the farmer should be to a certain degree scientific, placing confidence in the teachings of those who, by life-long study and experiments, have concluded certain problems as to the relation the hitherto considered "dead matter,"—the soil, the atmosphere, and man's agents—the mechanical appliances, bear to one another, in bringing about a more satisfactory result, in the agricultural puzzle. The general and so to speak wide-spread operations of the farm, the tillage of the land, breeding, rearing and fattening of stock, the proper and well-timed harvesting of the products of the soil, purchasing and sale of stock, the numerous other matters which continually present themselves in the management of land, also a clear and concise account, showing the result, must impress all but the most superficial observer that the practical and progressive farmer must be endowed with a mind of considerable ability and resources. Such a man will not, if his heart is in his work, find any difficulty in grasping, from the experience and writings of others, the useful suggestions that may be culled therefrom, moulding and forming them, by his own daily experience, on whatever soil he may have in hand, enabling him to discriminate rightly between the appliances requisite to make effective the nutritive elements already in his fields, and those which keep up the lasting productiveness of his soil, which eventually will tend to deserved success. It must be strongly impressed and clearly understood that the mechanical operations of cultivation, however well-timed and deeply performed, do *not* of themselves *add* anything to the soil; they, however, most certainly *aid* in bringing into activity many constituents now dormant in the ground. The physical and chemical condition of the field will, without doubt, be improved; but the chemical store has *not* been increased, only made more come-at-able. The power of the soil or land to assimilate and convert to the use of plants the elements of food supplied by the atmosphere is

brought into greater activity; the rain percolates more freely, carrying with it, to be detained by a well-pulverised soil for the use of plants, the carbonic acid and ammonia of the air. The repeated exposure of the soil to the general action of the atmosphere, frost, &c., by means of ploughing, subsoiling, and other agricultural operations, as is now fully acknowledged, causes a decomposition, and likewise an assimilation of hitherto inert mineral matter, while the carbonic acid and ammonia of the air unite with the various acids of the soil. Reliable authorities have explained that the atmosphere contains every organic constituent of the plant, in the form of ammonia, carbonic acid, water, &c., and of these it is considered there is a sufficiency for the proper growth of our crops, if we would but open up and loosen the pores of the earth for their reception, affording easy access for the roots of our plants, enabling them to ramify, spreading themselves in search of their natural food.

That *all* soils are benefited by well-timed and deep culture few will hesitate to acknowledge, but on clayey lands especially these operations will show a strongly marked and profitable result. Cold and stiff, they are more difficult to deal with than a lighter soil, in many instances adhesive to a troublesome degree, yet, with proper and judicious culture, will attain to a proportionately higher standard of fertility than ground of a lighter nature, thus recompensing the tiller for any extra outlay. "Jethro Tull," remarking on the advantages of the thorough and deep moving of the soil and subsoil, expresses it as opening up "fit pastures" for the young and tender rootlets, enabling them to penetrate the lower stratum of the land in search of that food an all-ruling Power has placed there in store for their use, requiring in man to exert aright that controlling intelligence with which he is gifted. By applying labour, intelligence, and energy, he can convert the constituents of this hitherto supposed "dead matter" into substances designed for the full development of vegetable life, in its turn sustaining animal creation and the nobler man.

There are other advantages which we cannot afford to overlook, in the great importance we attach to a well-cultivated and pulverized soil, and which can hardly be overrated without omitting to recognise other factors which conduce to add elements tending to the success we rely on, as a recompense for the extra labour, care, and expense bestowed; that is, in opening up the land, we strengthen and increase its power to absorb the fertilizing gases of the atmosphere, making it more retentive of those substances added to the land in manure, thereby encouraging the solicitude of the soil,—if the expression may be allowed,—to prevent the loss of the most valuable constituents applied. The power of absorption greatly differs with the nature of the soil, and this valuable property will be accelerated and quickened

in well-manipulated land, the more thoroughly the various ingredients of the soil are brought into a separated and divided state. That deep cultivation is consonant with the teachings of science may be inferred from the greater importance that is now attached to the deep moving of the soil by the cultivator, in preference to deep ploughing, by those who have had ample opportunity of forming a sound opinion on this subject; this may be gathered from the fact that the larger proportion of the work done by steam-power is by the cultivator, from which we may safely conclude that the deep moving of the land, rendering percolation and aëration more perfect and active, without bringing the—in its present state—infertile and sour subsoil to the surface, is the true and correct mode of dealing with this important subject. These operations also assist and develope to a marked degree the capillary force natural to the ground, making more accessible a resource whereby the plant can draw a good supply of moisture in dry and uncongenial seasons, thus exerting an important influence in mitigating and lessening the too frequent occurrence of mildew, which, in seasons favourable to the development of fungus, tends to the destruction of plant life.

There are many other advantages secured by well-timed and deep culture on which we have not touched, but we find them so forcibly and prominently enumerated in the paper on drainage already alluded to, p. 678, that we deem it would be but an encroachment on another's field of labour and thought were we to repeat them, as nothing foreign to the clear, forcible, and concise deductions therein set forth can be brought forward. But, in conclusion, let us reiterate the hope that those contemplating deep culture, with the view of benefiting their land, and increasing the producing power of their ground, will dwell carefully, and with unbiassed thought, on the many advantages so clearly set forth, as to the almost sure and certain reward that awaits the coupling of "science and practice."

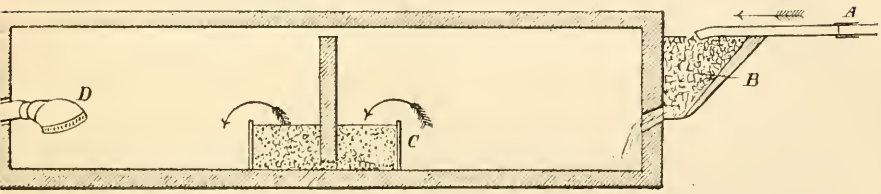
How to Supply a House with Pure Water by Gravitation.

By D. SYM SCOTT, Ballinacourte, Tipperary.

Having had some experience as a hydraulic engineer, I need make no apology for bringing before the readers of the Journal a subject apparently so foreign to forestry, because many of them will probably have to undertake similar operations on a more or less extensive scale, and any practical suggestion will be to them, as it always is to the writer, very acceptable. Moreover, I maintain that every house of any pretension should be prepared against an emergency, such as in the case of a fire breaking out, by having an ample command of water supplied by gravity. To secure this, it is sometimes necessary to utilise a mountain stream impregnated with a vast preponderance of vegetable matter. It also happens at times that the source cannot be depended on for a permanent supply. In either case it is expedient to have a filtering tank and reservoir. A reservoir should always be built at a point say ten feet above the level of the eaves of the house. The dimensions will be according to requirements and supply of water. In excavating for a reservoir, the hole ought to be large enough to allow the walls to stand clear of the earth. If the bottom is rock, it only requires a flooring of cement; but if at all porous it is much the safest plan to puddle the whole floor with strong tenacious clay, and then pave the entire bottom with sound, hard-burned bricks, laid in Portland cement made up with well-washed river sand. The side walls are built with similar materials, plastered on the outside with water lime cement and on the inside with Portland or Roman cement. When the side walls are firmly set and dry, clay ought to be tamped in all round so as to puddle it perfectly, which if properly done will prevent leakage from either side. The roof is arched with brick, and puddled with clay. A partition wall parts the tank into two divisions. At the bottom of the centre wall each alternate brick in the first course is left out, forming pigeon-holes. On each side build two low walls, and between these put in roundish gravel in the bottom. Over this put charcoal well burned and clean, ground to a size ranging from peas to pigeons' eggs. When filled up to the level of the low walls cover the whole, walls included, with sheet iron finely perforated and coated with patent solution. One brick more is then laid on to

keep the filter in position. The water is introduced to the tank through a bed of gravel placed outside the wall; an arrangement which prevents filth from getting into the tank, and being apart from the interior can be renewed without disturbing the water. It must be remembered that gravel is not a purifier, it only acts as a strainer; hence the utility of using it to receive the water from the conductor.

If the fall is regular the water may be brought from the source to the reservoir in flanged clay pipes with cemented joints, but when clay



Sectional View of Reservoir with Filters. A is supply pipe; B, gravel strainer; C, filters; D, draw-off pipe.

pipes are used they ought never to be under 4 in. inside diameter. This class of piping costs about five or six pence per foot. From the reservoir to the house I would recommend cast-iron underground faucet pipes coated with patent solution. Pipes of 2 in. inside diameter will cost about one shilling and sixpence per yard. Bends, tees, and traps to match, four shillings and sixpence per pipe of six feet lengths. Reducing the foregoing statements into practice, I have constructed 1,100 yards of waterworks at the following outlay, viz., £127 10s., all complete as above.

THE INFLUENCE OF TREES ON RAINFALL.

From observations made by M. Fautrat, relative to the comparative influence of leafy woods and resinous on rain and the hygrometric state of the air, recently communicated to the Paris Academy, it appears that pine forests have a much greater influence on the hygrometric state than others; so that if the vapours dissolved in the air were apparent, like fogs, we should see forests shrouded in a large screen of moisture, and in the case of resinous woods the vapoury envelope would be more distinct than in that of leafy woods. M. Fautrat also shows that pines retain in their branches more than half of the water that is poured upon them, whereas leafy trees allow 58 per cent. of the precipitated water to reach the surface of the ground. He suggests, therefore, that in planting with a view to oppose inundations, it would be advisable to choose by preference resinous trees, as offering a better covert.—*Science-Gossip.*

Draining.

As many overseers are entrusted with the making of farm drains, or, more correctly, the draining of farm lands, a few words on such a subject will doubtless be of interest to some of your readers, although I do not intend to bring before them anything of a new or unusual nature.

Any practical remarks on whatever subject connected with our profession have always some interest to us, even if they only confirm our previous ideas. To exhaust the subject would occupy a great part of your Journal for several months to come, but I mean to confine myself to as few sentences as possible.

Draining in Roxburghshire has been carried on very extensively for the last sixty years. The different systems practised are now very numerous; some of these are:—The cross or irregular stone drain; the furrow or parallel stone drain; the rough stone drain; the broken stone drain; the stone and tile or pipe drain, and again tiles and pipes have been used in a variety of ways.

Tiles were introduced here about the year 1846, and pipes shortly after. As material is of primary importance I may begin by a few words about pipes, which are now so well known as to need only a passing remark. They should be of good clay and well burned: not too soft to be easily destroyed by frost or broken in cartage, and not too hard to prevent the water percolating. They should be perfectly straight and square cut at the ends.

Two-inch pipes are the smallest that should ever be used. An inch pipe will run more water than is often found in many drains, but should the ends shift or be misplaced there is so little to spare, that there is a risk of the whole drain being rendered useless before it has been completed. Main drain pipes should be used of a size to contain all the water falling into them at all times, so as not to choke back, and consequently silt up the branch or furrow drains. These main pipes I prefer to those of an oval shape, as the bottom is narrower and runs clearer when there is little water in the pipes. It is of great importance also to have main drain pipes made with openings in the side to admit the end of the small pipe, as in breaking an opening after they are made, many pipes are smashed and many more so cracked as to go to pieces in the drain, which is tenfold worse.

We shall next consider very briefly the making of drains. The main drain should be opened first, and the ends of the small ones, for three

or four yards, done by the same party with at least as much bottom as will allow of two pipes being laid in their position, and space for the scoop to draw out the loose earth when the drain is taken over by the man who is to make it. This enables the joints to be made much safer than can be done after the main drain is finished and filled in, the filling should be done every night so as to prevent slips or dashes of surface water getting into the drain and shifting or silting up the pipes. Main drains cannot always be made in straight lines, as they must follow the course of the lowest part of the ground, but the straighter they can be made the better.

In proceeding with the making of branch drains, the drainer should first stretch a cord along one side of the proposed line (it is desirable that it be a long cord, say, not less than twenty-four yards), and rut it evenly with a sharp spade, returning in the same way on the other side, regulating the breadth according to the depth of the drain and the description of soil to be cut through. After this he must find his way to the required depth as best he can with pick, spade, and scoop. A soft bottom is easily taken out with a half-worn spade, and cleanly scooped to the bed of the pipe with an even slope, or level, as the nature of the ground may require, all hard substances or stones being carefully removed. Where the bottom is hard and gravelly it is best done with the pick, and a sufficiency of fine earth must be left in the bottom to permit the pipes to lie smoothly. The sooner the pipes are laid in, after the bottom is taken out, the better.

Where draining is carried on to any extent the pipes should be laid in by a thoroughly trustworthy man, who is not likely to be influenced by the plausible stories of the piece-work men who seldom scruple to try to get their work off their hands an inch or two less than the proper depth. The pipe-layer's first business is to see that the drain is cut to the required depth with the proper fall, by means of a cross-headed pole. Pipes can be best laid in the soft-bottomed drains by means of a "cleek," as a man going into a soft drain with his feet generally treads it into a puddle, quite unfit for any pipe to be laid in. In quicksand a thin layer of well-drawn straw is very beneficial. Perhaps the most important operation of all is covering the pipes with earth. If in so doing a stone of any weight falls upon the pipe, it runs a great risk of being broken, and covered up unseen. The pipes should be covered with three inches of the soil from the sides of the drain, or where a sod has been taken off the top and is not intended to be replaced it should be put in next the pipes. Farmers sometimes leave the filling of drains to be done with the plough, which we consider a decidedly reprehensible practice and very little saving in the end.

M. R.

Floods and Forestry.

The present rainy season has left numerous instances all over these islands to show that here, as well as on the Continent, this is a public question of immediate importance. The ravages on the Ochil hills betwixt Tillicoultry and Dollar may be brought forward as striking instances of our text. But the north-east coast from Yorkshire to Aberdeen might afford many parallel instances; while later, Skye was visited by a flood equally severe.

The Highland tourist knows that Stirling is the border-land betwixt the rugged scenery of the Highlands, and the plains which are the glory of East Lothian farmers. He is now only about to enter the land of brown heath and shaggy wood. But as he has previously been hurried over the now richly cultivated fields of Bannockburn, the abrupt escarpments of the Ochils, strangely wild amidst abounding triumphs of scientific agriculture, must have gladdened his eyes. For here at last are the precursors of those serried crags, rough covries, abrupt peaks, and still lochs, to see which had been the motive of his journey. On the 23rd of August last the numerous little manufacturing towns along the base of the range were in sore anxiety. It had rained heavily the previous night, and in the early morning the oldest inhabitant experienced a new sensation. The hills along an area of about eight miles had a white covering of foam; it thundered and lightened the while; the mountain streams enlarged their course, and the water made new channels; a scalp on the abrupt face of the hills above Harvieston House still remains, where the surface soil to a depth of 5 feet and a breadth of 20 feet was suddenly removed. The torrent of mud, water, and *débris* was broken by the plantations at the hill's foot; but ere its force expended it knocked down a well-built wall, and carried away a bridge, thus rendering the turnpike for a while impassable. At Tillicoultry the only fatalities occurred, a mill master being swept down by the current in attempting in vain to save the lives of two of his female hands. But at Dollar the flood left the most permanent marks of its powers, both in the romantic glen leading up to Castle Campbell, and along the downward course of the burn through the town till it joins the Devon, a small affluent of the Forth, near the railway station. The ordnance map shows the straight course of this streamlet to be little more than a mile and a half. But the contour lines mark

a descent in the space from 2,100 to that of 100 feet above the sea level. The inhabitants of some houses in Dollar were that morning awakened by other noises than the usual quiet rippling flow of this streamlet,—harsh rasping sounds of huge boulders grating, capsizing, and breaking, and above all a thundering noise of a head-wave, lasting only a quarter of an hour, but which indicated the time of most of the damage. The hills at and beyond Dollar lose much of the abrupt face so characteristic of them without coming up the valley, and now take on a thicker alluvial covering. Along the course of the burn is first the alluvial soil, then a thick bed of gravel and boulders, which geologists call boulder clay; this again rests on thick beds of clay, probably remnants of the time when the Forth washed the base of the hills. The head-wave exerted its force on the boulder clay and surface soil. In the Castle Campbell glen just below the ruin a bridge was swept away, and on a sward where wild roses used to grow, a long embankment of boulders, many of them several tons in weight, and in some places four feet high, was raised. So much for the constructive power of this mountain torrent. On entering Dollar it began to show its destructive effects on a public road running on either side of it. It cut it in three or four places, notably where at one place it cut not only through the thirty feet of roadway and past, taking a garden plot and the front wall of a twin villa; pianos, chairs, and other household goods sailing downwards to testify to the thoroughly awakened inhabitants below of the violence of the torrent. A huge monument of gravel boulders and sand was soon raised to this at a low bridge where the stream is crossed by the railway. The head-wave appears to have lost its transporting power here. The torrent, thus prevented from joining the Devon, burst down the railway line, ultimately breaking the embankment, so as temporarily to stop the traffic. It took over 500 waggon loads to remove this accumulated heap of boulders and gravel; nearly 3,000 tons of matter must have been accumulated here in little more than an hour. The embankment up the glen must represent at least an equal weight of stones carried by the torrent. Over £2,500 will be required to repair the ravages done to the municipal works of Dollar alone. A few miles further north damage to the extent of £350 was done at the same time on the estate of Mr. Christie, of Cowden. Here, also, part of the public road was washed away.

Clumps of trees grow at irregular intervals along the sides of Dollar burn. Their site marks spots where the banks withstood the torrent; the bare portions mark where large slices were washed away. This is markedly the case just at and above the site of the wrecked twin villas. Again, note that the stream began to ravage the banks just

after it had emerged from the wood in which the ruins of Castle Campbell are situated. The Ochils above this throughout their range are practically destitute of plantations. Only this much can be said, then, of the preservative powers of trees. The torrent, indeed, here as in other places, carried down trunks root upwards. The north road at Cowden is surrounded by a belt of plantation where it was partly carried away. Still a dispassionate observer must conclude that the woods which skirt the base of the hills greatly mitigated the effects of this calamity. Would they not have been nearly obviated if the rain-cloud had not broken on bare mountain sides, but on tree-covered slopes? We do not stay to prove how this would ultimately be a more profitable investment of capital than grazing. Even if it were not so, this is just one of the cases where private interests must succumb to the common weal. If such seasons as the present are to recur in cycles let us prepare for them, though our successors only reap the benefits. The blessing of saving life and property in coming years may follow our present planting of fir and larches. But Italian engineers write that trees are the best preservatives against destruction caused by mountain torrents. The immediate cause of the devastations along the Ochils was not continuous rainfall. It had done so on the previous night with no perceptible effect. The mischief was done in an hour on the morning of the 28th—the worst of it, indeed, in a quarter of an hour. Granted a heavy rain-cloud to break on a mountain range at sufficient height to call in force, according to the laws of hydraulics, to effect the measured results, then the whole matter is explained. In our ignorance of the time of coming of the rain-cloud, let us be forearmed. Mr. Coyne, C.E., superintendent of the Edinburgh Waterworks, has stated that in 1876 a sudden spate at Harperrig reservoir did great damage, carrying away walls and embankments. It only lasted an hour; and as the rainfall is measured by the resident keeper, it is known that much heavier falls have since occurred, with no damage to the city property.

Of course we would have the Pentlands planted as well as the Ochils. The ugly slip on the Queen's Drive above Duddingstone, which occurred this summer, may suggest that the Edinburgh Queen's Park, as in King David's time, should be planted. Highland travellers may call to mind many spots of their summer wanderings as they muse on our theme: in special such rugged spots round Loch Erne side, along which the Cullander and Oban Railway winds, streaked with silvery mountain torrents and great lichened boulders ready to topple down on the application of slight impetus. The loch scenery would be all the more enjoyable where we saw planted mountain sides keeping the rails clear of very ugly impediments. This is no fancy grievance. For more than once this summer the train was seriously delayed by such boulders blocking the line.

The Last of the Oaks of Birnam.

By D. McKENZIE, Forester, &c., Murthly, Perthshire.

Birnam has been rendered classic ground by the immortal Shakespeare, and in ancient times formed part of the Royal Forests of Scotland, being then covered with a vast forest of oak and probably Scots fir. The "last oaks" are, according to tradition, remnants of this ancient forest, and must, at this date, be close upon one thousand years old. These venerable monarchs are three in number, consisting of two oaks and a plane (sycamore). One oak and the plane are growing close to the river Tay, on the south bank, and immediately behind the Birnam Hotel, and about 800 yards east of Dunkeld Bridge. On account of their remarkable antiquity they are objects of great interest to the numerous tourists and others who frequent this romantic and picturesque neighbourhood.

The girth of the oak at 5 ft. from the ground is 18 ft., and that of the plane, which stands 80 ft. west of the oak, is 19 ft. 8 in. When the celebrated traveller, Dr. E. D. Clarke, visited Dunkeld early in the present century, he examined and measured these grand old trees, and seems to have been so impressed with their gigantic proportions, and enchanted by their magnificent surroundings, that I cannot do better than quote his remarks:—"To enrich this noble scene, the finest trees are seen flourishing with the greatest redundancy. How weak and groundless are the expressions of Johnson respecting Scotland and its timber, where one beholds this luxuriant valley proudly decorated with majestic oaks, sycamores, limes, beeches, maples, and all the glories of the forest! I measured a single oak close to the ferry, and found it to be 17 ft. in girth; and near it stood a sycamore of much greater magnitude." It will be seen by these measurements that the oak has only added a foot to its girth in about 70 years. The next oak of interest, which is said to be of the same age, is growing two miles to the south-east of the latter two trees, and is 10 ft. 4 in. in girth, with a high and wide spreading head. It is called the "Hangedmen's Tree," and was used in olden times by the lords of Murthly for hanging thereon thieves and other offenders against the laws; hence the name. In the year 1094 King Duncan had his camp about half a mile from where this tree stands, and also held courts of justice on a small hill to the south-west of it. Some even

assert that he also hanged his miscreants on this very tree. The whole of these trees lay in the line of march of the English army, who came under the command of Gerard Earl of Northumberland to place Malcolm on the Scottish throne instead of Macbeth, and branches may have been taken from off these identical trees to disguise the army when on its way from Dunkeld ferry (whither they went to meet allies from the north) to Dunsinane Hill, the stronghold of Macbeth. The witches, whom he regularly consulted, had advised him to fortify this hill, and here they promised him perfect security, until "Great Birnam Wood should come there against him"——

> "Be lion mettled, proud: and take no care
> Who chafes, who frets, or where conspirers are;
> Macbeth shall never vanquished be, until
> Great Birnam Wood to high Dunsinane Hill
> Shall come against him.
> *Macbeth.* That can never be:
> Who can impress the forest: bid the tree
> Unfix the earth-bound roots?"—*Shakspeare.*

It is further stated that the sycamore and oak were planted for the lord and lady of Murthly to tie their ponies to while they attended worship in St. Jerome's chapel, which was situated on the top of a small knoll on the north side of the Tay. Twenty years ago a descendant of the celebrated fiddler, Neil Gow, told me that while Neil (who was passionately fond of Highland whisky) was away on the hill of Birnam at a drinking and fiddling bout in some of the smuggling bothies which then existed, the night turned out very stormy, and Neil could not find his way home, but stayed till a late hour in the morning in the bothy. He at last ventured out and made for the ferry, but on account of the storm the ferryman who lived upon the opposite bank could not hear him, so Neil sat down at the foot of the oak above referred to, and slept so soundly under the soothing influence of the "mountain dew" that he was only awakened by the river, which had risen rapidly, rushing over his legs, and was almost swept away by the rising flood. Surprised and thoroughly aroused by his dangerous position, he was quickly brought to his senses, when he found that he had missed his way and was at the wrong ferry! As soon as he got home he is said to have composed the famous tune,—"Neil Gow's farewell to whisky,"—so said his friend. Be this as it may, both the locality and the trees are worthy of a visit by those who have the time at their command.

The Cultivation of Hemp—Cannabis Sativa.

HEMP is an annual plant, growing from six to eight feet high on good soils, and in some parts of the Continent to twelve and fifteen feet. It is grown chiefly for its fibre, which is employed in the manufacture of cordage, cloth, &c., and the seeds produce an oil which is used in medicine. A deep, rich soil is essential to the growth of hemp, such as is to be found in Holland, the fens of Lincolnshire, Isle of Ely, Norfolk, and Suffolk. It is a good eradicator of weeds, which it effects by robbing them of their nourishment, although some cultivators attribute this property to some poisonous quality in its roots. It will not thrive in a cold, stiff clay soil. The land upon which hemp is intended to be sown should be heavily manured at the rate of 25 to 30 tons per acre, dug or ploughed deeply, and raked or harrowed say five times before sowing, which should be done about the middle of April, that being the best season. It should be sown in drills eighteen inches apart. Six pecks will sow an acre by drilling, whereas three bushels would be required if sown broadcast, and thinning and pulling are much facilitated by drilling, besides a large saving of seed is gained. In the choice of seed the heaviest and brightest coloured should be preferred, particular attention being given to the state of the kernel, and some of them should be cracked to see if they have the germ or future plant perfect, as in certain cases the male plants have been drawn out too soon, *i.e.*, before they have impregnated the females with pollen ; in which case, though the seeds produced by these female plants look well, and seem fair to the eye, yet they will not grow, a fact well known to the hemp growers of Lincolnshire and the Eastern Counties, where hemp is most cultivated, and who have paid for their experience on that score. The male plant ripens before the female, and is pulled a month sooner, from the middle of July to the middle of August.

The first pulling is called the "*fimbe* hemp," by being gathered before the plants are quite ripe, and have shed their farina or pollen dust over the flowers of the female plants, or, as they are called, "*karle* hemp," without which the seeds will prove abortive and produce nothing if sown the next year. Nor will those concerned in the oil-mills give anything for them, as they are only empty husks without any kernel to produce oil.

The second pulling takes place a little later, about Michaelmas,

when the seeds are ripe. This karle hemp is tied up in bundles of a foot in diameter, which are laid in the sun a few days to dry, and then stacked up, or housed, to keep it dry till the seed can be thrashed out. An acre of hemp on a rich soil will produce close on three quarters of seed, which, with the unwrought hemp, is well worth the attention of the farmer. Hemp should never be allowed to remain ungathered till the seeds are fully ripened, as the texture becomes coarse, and can never be got to the same degree of fineness and quality as that of hemp gathered before being fully ripe. Therefore to obtain good seed a piece of ground should be selected, and the plants left two feet apart each way, and allowed to stand till fully ripened; the "fimbe" hemp being allowed to stand likewise till fully matured, so as to shed its farina over the female or seed-bearing plants, when the yield of seed will be much superior in all respects.

Hemp growers, as a rule, leave the flowers, leaves, and roots on the ground to enrich the next crop. D. D.

Deep Soil.—The soil of Nebraska, according to President Furnas, is of a remarkable character, three-fourths of the whole State resembling alluvion, varying in depth from 5 feet to 150 feet—rarely less than 40 feet deep. Four-fifths of its ingredients are fine silica, and the remainder consists largely of carbonate and phosphate of lime, requiring little or no drainage, and at the same time so retentive of moisture as not to be affected by drought.

Extensive Estates in America.—Probably the largest landowner in America is ex-Governor Abner Coburn, of Maine. Incredible as it may seem, he is the owner of not less than 593,000 acres, divided as follows:—Maine, 150,000 acres; Canada, 135,000; Wisconsin, 35,000; Dakota, 35,000; Michigan, 20,000; Minnesota, 18,000. His latest purchase is that of the tract in Dakota, and was taken of the Northern Pacific Railroad in lieu of stock, in which road he invested some 60,000 dols. A Maine paper says, "His agent, Mr. Whipple, has just returned from the West, whither he has been to look after Mr. Coburn's interests and see about the last purchase. He reports the land in Dakota as among the finest held by the governor. He says it is well adapted to growing cereals, and fine crops of wheat have been harvested in the vicinity the present season. One of the causes of the failure of the Spragues was land speculation. They purchased from Mr. Coburn six years since a tract in Maine for which they were to give 1,400,000 dols., and upon the same advanced 500,000 dols. The land was well timbered, but the Spragues could not keep it, and Mr. Coburn has now come into possession again, while the Spragues are out the amount advanced. The governor is said to be besieged with beggars of both high and low standing, and there is scarcely a day passes but he receives letters asking aid to help build seminaries, churches, and charitable institutions. He is reported as giving away upwards of 100,000 dols. per annum. Mr. Coburn is probably worth 6,000,000 dols."—*Lumberman, U.S.A.*

The Monarch of the Forest.

By RICHARD JANDRELL, Forester, &c., Hawkstone, Salop.

Now that the iron age of shipbuilding has about reached its climax, and the wooden walls of Old England are superseded by monsters of the deep in the shape of ironclads, the monarch of the forest, the oak, is apt to be discarded, and, in point of value as a timber tree, has to take a second and even a third rate place in the market of English grown timber. The great railway companies are also throwing it aside, and introducing to a great extent foreign oak for the construction of the framing of their carriages and trucks. The praises of the monarch have been sung by many thousands in bygone ages, and the Muses have induced many a bard to compose poems to his glory; and being a tried and true old friend, I think a few of his numerous excellences would not be out of place, but would add a laurel to his crown, if they appeared in the pages of the *Journal of Forestry and Estates Management*. In fact, I think the monarch of the forest almost needs an apology from the Journal for not speaking of some of his various uses before now; however, as our planet has not yet made quite one annual revolution since the Journal sprung into existence, and as a thousand years are as one day in the eyes of the monarch of the forest, perhaps he will not be offended, but will calmly submit himself to be spoken of by one of his numerous admirers. I ask any lover of the beautiful to produce a nobler sight in nature than the oak in its prime, if standing alone in the ancestral parks of our aristocracy, or in the modern pleasure parks of our numerous enterprising cities (should there be any oaks in such parks that have arrived at maturity), with its wide-spreading branches of perhaps 120 feet, and its height of something like 80 feet; its massive branches springing from a gigantic trunk at about 8 feet from the ground, and growing in romantic and beautiful form, having perhaps withstood the blast for three or four hundred years. However, with the sage's permission we will pass him by as an ornamental tree, and confine ourselves to speaking of his uses in the mercantile world.

The outside clothing of the monarch is steadily advancing in value, and the various chemicals which are used in the hasty manufacture of leather are obliged to own submission to the lasting influences of the monarch's tanning properties. With the substantial builder the

British oak is the universal favourite. If he be building a church or chapel, mansion or villa, from the floors and seats in the former to the construction of the galleries and roofs, what timber can be compared to the oak? and in the latter from the wood bricks that are firmly built into the walls to be used for the purpose of fixing the different window and door linings, to the lintels, beams, and joists, and boards for the ground floors, purlins, rafters, spars, and laths for the roof? For these purposes the British oak is classed A 1, on account of its durability, also for the internal fittings, such as shutters, doors, and their different framings, all kinds of wainscoting and skirtings for the lower rooms, and especially for the construction of the ground staircase. What timber is more suitable? In fact, it possesses an inspiring and majestic grandeur to the artisan, knowing as he does that when he is at work upon it for the above fittings, his handiwork will be seen and admired for generations to come, and if executed with taste and skill will add a lasting lustre to his name. Again, for nearly all kinds of furniture, from the beautiful pollard oak drawing-room suite to the kitchen furnishings of the cottager, what looks so substantial and so handsome, with its beautiful variety of grain, as the oak? For the construction of ornamental work, such as the beautiful ornaments that are turned from the lathe, what timber for beauty surpasses the mottled pollard oak? Again, after the monarch has been buried for ages, whether it be in the shape of huge piles or of submerged trees in Irish bogs, he is eagerly sought after, and when found is quickly unearthed. In this state his timber is more valuable than ever, nature having given to it a rich black appearance far prettier than ebony. This timber is used for the manufacture of the beautiful bog oak brooches, earrings, lockets, watch-guards, &c. Again, passing from the ornamental to the useful, the oak cordwood is not to be surpassed by any other wood for the manufacture of charcoal, or for the Yule log for the Christmas fire. The timber is also unsurpassed for the construction of dock gates, lock gates for canals, and flood gates for watercourses; also piles for engineering purposes, spokes, and framing for waggons and carts and various farming implements, cleft oak gates and sheep hurdles, gate-posts, fence-posts, &c., and some thousand and one other things too numerous to mention. In concluding this paper I am sure of one thing, and that is this, that all our readers will hope for a brisk trade during the present year; and should it prove so, all buyers and sellers of oak timber will rejoice. At the present time I am sorry to say that oak timber is quite a drug in the market.

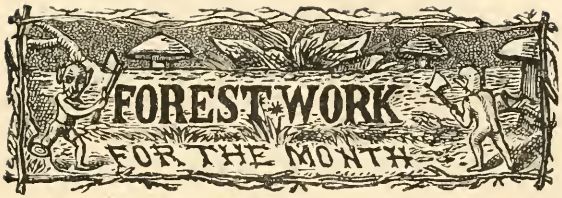
The Great Trees of California, &c.

We do not seem to be aware that in calling these trees by the name of "Wellingtonia" we are guilty of a want of courtesy to our American cousins; yet the American evidently has justice on his side when he complains of the English botanist who so named these largest of existing trees. As they grow only upon American soil, good taste might have dictated the name of "Washingtonia"; but it was decidedly wrong to name them after a British hero; and this error becomes the more glaring when it is considered that they were already, in botanical fashion, classified and named. There was a tree, from the same region of California, well enough known before the great trees were discovered, which was commonly called "Redwood," from its colour. The American botanists gave it the name of *Sequoia sempervirens*. This name was derived from a noted half-blood of the Cherokees, called George Guess, but whose Indian name was Sequoiah. When the great trees were discovered, as they were of the same genus, they were naturally classed with the others, and called *Sequoia gigantea*, a title which we ought always to give them, and we should do all in our power to erase the other name, by which they are most commonly known amongst us. The tree first received the name of *Sequoia gigantea* so early as 1854, from a French botanist, M. Decalsac, and it is described by him and classified in the "Bulletin de la Société Botanique de France," vol. i., p. 70. At first only two groups of these trees were known, that of Mariposa and that of Calaveros; but several others have been since described. They are always found in groups, and at Mariposa there are about 200 of these trees. There are none of them in the Yosemite Valley, but the Mariposa group is only about sixteen miles due south of the Yosemite, and as they are generally visited on the way to that valley, itis natural to talk of them and of its scenery together. These trees are confined to a region between lat. 36 deg. and 38 deg. 15 min., and their growth is limited to an elevation not lower than 5,000 ft. and never higher than 7,000 ft. They are thus very limited in their geographical range. The Mariposa group is visited from Clarke's Ranch, standing on a hill about 1,500 feet higher up, or about 5,500 feet above the sea level. The largest tree in this grove is the one known as the "Grizzly Giant." It is said to measure 300 feet in

height, and is 93 feet 7 inches in circumference at its base, or over 30 feet in diameter, and 68 feet 3 inches at 11 feet above the ground. As the tree has suffered from burning, these measurements scarcely do justice to its true growth. Half way up there is a branch 9 feet in diameter, which itself would make a very respectable tree. The trees are all named after great men, such as Longfellow, Abraham Lincoln, and President Grant, The "Grizzly Giant" is so named because it has passed its prime, and shows all the marks of age, and endurance of time and rough weather. Another large tree has been blown over from its roots, which is known as the "Fallen Monarch." One very old tree has fallen, and has had the decayed wood of its central part burned out, and which now lies like a great tunnel, so high that a man on horseback can ride through a portion of it.

This gigantic Californian tree has only one rival, and that is in Australia and Tasmania. It is known as the *Eucalyptus amygdalina*, which attains to a height of 400 feet. It is even said to reach 480 feet, thus exceeding by 150 feet the highest specimen of the *Sequoia gigantea*. But the largest of these Australian giants does not exceed a diameter of 81 feet. There is, however, another big tree, which far exceeds the sequoia in thickness of stem; it is the *Baobab* or *Adansonia digitata;* but this species, although swelling out at the base, is of a low growth, never exceeding 70 feet in height. If both the thickness and height of the great trees of the Pacific slope be taken into consideration, they stand, as yet, without a known rival. A gentleman who had lately returned from a visit to California was once asked how the great trees were to be described, from the want of anything approaching them in size in the Old World. He had recourse to selecting two trees about thirty feet apart, and then he said, "Look here, one of the great trees of California fills up a space as large as that." It is the only way to realize on an English lawn the size of these giants of the botanical creation. W. R.

A Weeping Hemlock Spruce.—A weeping form of this is described in the *Rural New Yorker*. The habit is so decidedly weeping, and the leaves and branches so thick, that it was at once suggested to graft it upon high stocks about the same, for instance, as the Kilmarnock weeping willow is worked upon a stock of which it is a variety, viz., *Salix caprea*. But the great expectations of securing an evergreen tree-form of unique and incomparable grace, thus reasonably entertained, have not been fulfilled. Mr. Samuel Parsons, of Flushing, writes as follows:—"We graft it readily upon high stocks in the nursery, but it does not thrive as well; the naked stem cracks and suffers, and the massive foliage, like most evergreens perched on high stems, is too heavy for grace and proportion, and is beaten and tossed by the winds."



ENGLAND.

As there is now little prospect of frosty weather for clearing woods, the forester must do the best he can to remove all timber, poles, &c., before the young shoots make their appearance.

The planting out of all hardwoods should now be brought to a close, though conifers may still be removed from the nursery. Avoid, however, raising these during the prevalence of cold easterly winds.

It will now be very necessary to overlook and perhaps tie afresh, trees which require support, as March winds often severely try their stability. A good mulching around recently transplanted trees will also be very serviceable in keeping the ground moist. After very dry days, and when there is no fear of frost, a syringing overhead will also help such trees to husband the juices with which they are now not too abundantly supplied.

Keep road surfaces well raked in order to get them thoroughly consolidated before summer comes, and never allow ruts to form upon them. Repair wire fences and tree guards. Where the trunks of unfenced trees are liable to injury from cattle, deer, or sheep, coat them well with a wash of two parts cow-dung, with one of lime, and one of Stockholm tar.

In shrubberies, planting should now be finished as quickly as possible, and everything cleared up, so that the lawn may be rolled down at once. In sheltered situations it may even be necessary to mow grass plots before the end of the month.

Where rhododendrons are planted as ornaments on poor clay soil in wood-rides, or elsewhere, a dressing of cowdung and leaf-mould, forked in around them, will not only promote rapid growth, but also impart a glossiness to the foliage.

March should be a busy month in the saw-lodge, as timber required for early use should now be sawn up and placed in favourable situations for seasoning.

Besides the clays mentioned last month as being well adapted for

burning, peaty soils may with great advantage be similarly treated. The large quantities of organic matter contained in them are often prejudicial to vegetation. Marshy soils contain much humus, which is greatly changed by burning, and also rendered more soluble.

The forester should avail himself of a temporary lull in the works of the plantations to get on with his marking and numbering of oaks for falling. A simple calculation, based upon the number of loads or cubic feet of timber to be felled, making proper allowances for age and sizes, and situations in which grown, will enable him to ascertain approximately the total quantity of bark to be stripped and the number of hands required.

Having supplied the forester's demands throughout the season, the nursery itself will now require great attention. Where transplanting still continues, two years' seedling hardwoods should be removed early in the month, and one year's plants later on. One year's seedling larch may, however, now be transplanted at once, other coniferous seedlings being left over for the next month.

The preparation of seed-beds and the sowing of seeds may now be proceeded with. When sufficiently dry the ground should be well worked, and all stones and remains of former vegetation removed by hand. Afterwards the beds should be laid out long and narrow in form to admit of hand weeding. The seeds of ash, alder, birch, and holly may be sown upon the surface of the beds, either broadcast or in drills, and lightly covered by riddling over them some fine soil, laying it on to a thickness of about half an inch. As a considerable portion of the coniferous seed does not germinate it should be thickly sown to insure a regular crop. To keep off small birds, nets should be spread over the beds and supported by bent rods, care being taken to fasten them securely at the sides.

In choosing seedlings, or any young plants from public nurseries, examine well their barks, roots, and general growth.

In selecting a site for a new nursery, choose moderately open or friable land, with a fair exposure; these conditions, combined with average fertility of soil, should ensure fibrous root-growth, strength of plant, and general hardiness. Closely sheltered hollows and very stiff clays should be alike avoided: the one causes too rapid an upward growth, and the other does not favour the development of roots. Where artificial shelter is required a hedge of hornbeam or privet may be quickly raised.

One very important adjunct of the nursery is a plentiful supply of water within easy reach. The nursery should also be upon moderately level ground, as heavy rains may otherwise greatly injure young stock.

Buck seeds, which should have been well dried in the sun and

afterwards kept in sand, may now be planted. When larger seeds such as oak, chestnut, &c., have still to be put in, it may be advisable first to soak them in liquid manure.

In marshy land plant willows,—the yellow willow (*Salix vitelina*) and the almond-leaved willow (*Salix amygdalina*) for tying up produce and espaliers, and the osier willow (*Salix viminalis*) for the basket-maker.

Pluckley, Kent. A. J. Burrows.

SCOTLAND.

It is not often that February has come and gone with such mildness as we have this year experienced. Throughout the whole month the weather has been most favourable for all kinds of forest work. It may be premature to speak of the peeling season yet, but if the present favourable weather continues, there is no doubt but it will be an early one. Every forester, therefore, should do his utmost to get all necessary work finished off before that time.

After deciding on the oak plantations to be thinned, all brushwood likely to hinder the peeling operations should be cut down and carted off. If the plantations are of great breadth it will also be necessary to look out convenient lines of roads, on which to cart the bark to the drying stands. These temporary roads should be formed in easy curves and gradients, and will be found to be of great service in the way indicated, as well as for the after removal of the timber. If a wet day happens during this month the bark chisels and mallets should be overhauled, and put into working order ready for immediate use. The cutting of Box and Holly, Yew, and other evergreen hedges should now be carried on. The trimming of box hedges should be done with the shears alone, as the hedges are very soft and lack stability, and a false stroke with a hedge bill or knife in their smooth surface produces an unsightly gash which takes years to fill up again. As regards holly and yew, however, a clever-handed man with a good keen-edged knife will do as much work as half a dozen men with shears, and his work will also appear equally neat. Knives for this description of work should be perfectly straight in the blade, and will be found to work even better if the point is rounded off from the edge to the back, something in shape like the blade of an ordinary budding knife.

Continue the repairing of all kinds of wooden fences. Inspect continuous iron bar fences, straightening with a hammer and a wooden block any bars which may have been bent by the pressure of cattle, deer, &c., against them; and the workmen should also carry some staples or wedges with them, to be inserted wherever required. Also look over wire fences, repairing or renewing the posts, and tightening up the wires where they have got slack. Rotten posts and slack wires

quickly render a good fence perfectly useless, and precautions should be taken in time to prevent this happening. Ornamental evergreens, such as box, laurel, holly, and yew, may now be pruned with the pocket-knife, or cut hard back where necessary to keep them within due bounds. When such shrubs are allowed to grow up for years without any pruning, they, if grown quickly, are sure to become bare at the bottom, and require to be cut down to within a foot or two of the ground to get them well furnished again. Instead of cutting all the tops right off, it is a good plan, where a thick close mass is wanted of such plants as common and Portugal laurels, rhododendrons, &c., to select the most pliable of them to be cut about half through near to the root, and then bend them to the ground, "layering" them in the bare spaces between the stools. A few spadefuls of earth taken out to form a small trench, and the branch laid along it for a foot or two and held fast in its place with a stout peg, with the earth filled in over it, is all that is required to cause the branches to root and grow freely, quickly forming a compact mass of evergreens.

Be careful to collect at once all prunings of evergreens, especially box and yew, and burn them; because if allowed to lay about where cattle, sheep, or pigs can get at them, very serious consequences may be the result. Yew or box in a half-withered state appears to be deadly poison to many animals, and no risk ought to be run when they can be so easily put out of the reach of such animals by burning.

Those plantation drives which have been cut up by traffic in the winter, that are not likely to be carted over during the summer should now be put in order and well rolled down with a heavy roller, so as to obliterate all tracks of wheeled carriages, horses' feet, &c. A few grass seeds sown on any bare spots will soon make all look green and tidy.

The planting of all deciduous trees should be completed as early as possible this month. If delayed till the buds begin to swell and expand, the trees receive a check from which they derive no benefit.

In the nursery all the ground cleared of trees during the planting season should be immediately dug. If it is exhausted by the previous crop, it should receive a good dressing of well-made manure; and for a change, a crop of potatoes may be taken of it with much advantage.

Proceed with the transplanting of all seedlings from the beds into the nursery rows. Dig between the rows of all plants that have not been moved during this season.

The sowing of all seeds, except those of the coniferous family, ought to be completed this month, choosing a day for the operation when the soil is in good tilth.

ROBERT BAXTER.

Dalkeith Park.

IRELAND.

Thin young groves and exposed situations towards the end of the month. Collect the material into piles convenient to roads, and sell by auction. In preparing local sales of timber at this season of the year, it is advisable to have a mixed class of trees suitable for local wants.

Planting evergreens may still be continued, but care should be taken in keeping the roots from getting dry. On this one particular we are always most careful, and our undertakings are in every instance crowned with success. Prepare trees for transplanting next year by cutting their ball with the spade. A very good plan for preparing old hollies is to cut a trench round one side only, and leaving them two years before being removed.

Look over young plantations, and strike off where drains are required; also go over ground intended to be enclosed and planted, marking where drains are necessary. A few plants should always be kept on hand to replace about the end of the month any destroyed by hares or rabbits.

See to all the fences and gates, also repair all tree protectors in the parks and lawns.

In the nursery commence to weed and clean the ground during fine weather. Sow all sorts of keys and berries. If the weather is mild, sow beech near the end of the month.

Trim and dress the pleasure-ground. Plant the borders, and attend to neatness everywhere.

D. Sym Scott

Ballinacourte, Tipperary.

WALES.

Where draining, planting, thinning, and the removing of timber, have been occupying the men's time lately, the present month may be taken advantage of in pushing forward, as far as possible, various odd jobs which may have been left over during the busy season.

In the way of planting, the beating up of young plantations of two or three years old may be performed with plants of moderate size, as the young trees will be the means of sheltering them to some extent, and they will be of more uniform size with the rest of the plantation. Remove and transplant spruce, privet, and other evergreens to old and sheltered plantations where game cover is desirable.

The general thinning of hardwood plantations for sale will now be finished, or nearly so, but young fir plantations may be thinned up to

the end of the month. Continue binding fagots and carting home firewood.

Have all fences round plantations put in thorough repair, before the ground gets too hard and the stock is turned into the pastures.

Gravel and roll walks and carriage drives, and hoe and rake beds in pleasure grounds where the ground is dry enough; also roll grass lawns.

As all necessary plants will have been removed from the nursery, there will be both time and room for replanting and filling up the ground with young stuff. When plants have been growing for more than two years, it will be necessary to manure, and, if possible, to take a green crop from the ground before planting with young trees. Where space admits dig between the lines of plants, which will not only assist root growth but keep down weeds.

LEWIS BAYNE.

Kinmel Park.

JOURNALISTIC COURTESIES.—The following is the dignified manner in which the editor of the *Chicago North-western Lumberman* replies to an article in the *Menominee Herald*, supporting certain views in reference to the lumber interests of Ontonagon:—"If the *Menominee Herald* man imagines that he can induce the Lumberman to give him a free advertisement for his various slurring and sometimes lying paragraphs, he is mistaken. The game is too insignificant." Now we are quite sure that if we are the editor of a "country local paper," we are judge enough of lumber to know the kind of a log the editor of the *Lumberman* was sawed out of—hollow, punky, shaky, and *rotten*."—*Ontonagon Herald.*

FORESTRY IN THE PUNJAUB.—We learn from the *Indian Agriculturist* that the Chunga-Munga plantation in the Punjaub, which has an area of 7,000 acres, was commenced in 1865, and contains chiefly Indian blackwood (*Dalbergia sissoo*). The expenditure up to the end of 1873 was £26,000, including £5,000 spent during the first five years in unsuccessful experiments; £5,000 had been received from petty thinnings (firewood and minor produce, grazing dues, &c.). From a careful valuation and calculations made in 1873, it is estimated that the expenditure up to 1881, when the capital account closes, will be £97,000, and the value of the plantation will be then £170,000. The annual rainfall in he district is under 15 inches, with great heat in summer and sharp frosts in winter. The whole plantation has to be irrigated from a neighbouring canal, being debited with a charge of 4s. per acre per annum for the use of water alone. The land on which the plantation stands was formerly almost valueless, and would not fetch an annual rental of 2s. per acre, but now 12s. and even 20s. per acre is obtainable. The rents mentioned include the water-rate of 4s. per acre per annum. This plantation is intended eventually to cover 30,000 acres, and will undoubtedly prove a great success as regards direct financial profit, a supply of timber or firewood improving the soil, and rendering it fit for cultivation, and ameliorating the climate.

[*Correspondents sending letters signed with initials or fictitious names are requested to enclose their name and address, as otherwise their communications cannot be inserted.*]

ABIES DOUGLASII.

SIR,—This tree may be found interspersed through most of the plantations at Penrhyn Castle, in North Wales, where it thrives remarkably well, especially where it is well sheltered.

The leader, however, on passing above the average height of the surrounding trees, being so slender and brittle, generally gets broken over by the wind, thereby causing the tree to send forth a plurality of leading shoots, which by no means enhance its beauty. If these were corrected, and only one left as a future leader, it would probably fare the same as the previous one.

Two trees of this kind, standing within a few yards of each other on the side of the carriage drive leading to the castle, are of the following dimensions:—Circumference at three feet from the ground—No. 1, 7 feet 8 inches; No. 2, 10 feet 10 inches; spread of branches, 40 feet. They are well clothed with glossy foliage to the ground, seem in perfect health, and would have been model specimens had their leaders not been broken off.

I have also noticed this frailty of the leaders of the *A. Douglasii* on an estate in the north of Ireland.

Perhaps in some places it attains a taller growth, and may not meet with the same obstacles as here, most of our woods being exposed to the high winds blowing in from the Irish Sea, and lying at a considerable elevation above sea level; but I doubt very much if this tree will be found rising to a great height anywhere, except in low-lying and well-sheltered districts.

I have been thinking that a plantation formed of it alone, or mixed with silver fir (whose height and rate of growth more nearly approaches that of the *Abies Douglasii*), might succeed better than when nursed up amongst the ordinary run of forest trees; and I would feel obliged for some opinion on the subject from others interested in the successful culture of this valuable species of fir.

AN OBSERVER

THE SILVER FIR.

SIR,—We have here some fine timber of the silver fir. I measured two hoary-headed specimens yesterday. They measured in circumference, at four feet from the ground, 13 feet 9 inches and 15 feet 4 inches respectively. About fifty-six years ago three avenues were planted from the progeny of those trees, many of which now measure seven feet round at three feet from the ground. We consider the silver fir one of the very best for planting in situations where we have doubts of larch succeeding, but would never think of planting it where we expect larch to thrive, as we get five shillings more per ton for the latter than we do for the silver A timber merchant had a large quantity of very fine silvers lying at the railway station here; he was not satisfied with the price first offered, so kept them on hand for about nine months, when he disposed of them at 13s. 6d. per ton. They were fine clean-grown trees; the diameter of the butt ends would average about thirty inches. A quantity of silvers have been used as sleepers for the railway here, and, next to larch, are considered the most durable. As I have had some discussions with the railway officials on the merits of the larch and silver, we had several sleepers of each marked when being laid down ten months ago, the result of which I will report in due time.

The Gardens, Warren's Court, Co. Cork, P. SHARP.
February 23, 1878.

PROSPECTS OF ADVANCEMENT OF UNDER FORESTERS.

SIR,—I have read with great interest and some anxiety the letter of an "Under Forester," at page 721 of your last number. Being only an apprentice forester, and not yet out of my teens, I beg you will not think me too presumptuous in venturing to write something for your pages, although I am afraid it is somewhat of a personal matter; still as I believe there are many more young men in the same difficulty as myself, I trust you will kindly bear with me while I try to state my case as fairly as an "Under forester" has done.

My experience of a forester's life is, of course, but short; however, it has been long enough to rub the roseate hue off it, which I had pictured to myself when I left school at the age of sixteen, and began life with the view of ultimately filling a leading place as a forester in this country, or in the Indian Forest Department—if a good education, a strong love for the profession, and my own assiduity and willingness to learn, would qualify me for filling any such important posts as those I have dared to mention. As I have already hinted, I have nothing to complain of in regard to the liberal education my kind, hard-working, and industrious parents have given me, thanks to them, and to the near neighbourhood in which we lived to an excellent parish school in the south of Scotland, and afterwards to two years spent at a grammar school in the county town. At the end

of the term when I left the grammar school, my worthy parents were extremely anxious that I should go to College to qualify myself for one of the learned professions, although they could ill afford the moderate amount of means required to keep a young fellow at the Scotch universities. Being possessed of a robust body and lots of good health, I had a strong inclination for a co untry life, and would have readily taken to the plough had my parents permitted. Being denied that, I was looking out for some other country occupation of a nature less objectionable to them, when I fell in with a forester on a neighbouring estate, who had just had a letter from a man who had served under him some years before, and who then held an appointment in the Indian Forest Department.

The contents of that letter decided my choice of a profession, and through the influence of this friendly forester I was settled down in my present situation nearly three years ago. Since then I have fought on through rough and smooth, and done my best with a good will to give every satisfaction to a kind and good-hearted master, who has served here as a forester—boy, man, and master—for nearly half a century. I believe I have succeeded in winning his esteem and confidence as a workman; and putting all things together, I dare say most of my brethren would say I have done very well, and acquired a fair knowledge of the profession in the good old practical way, as well as reading up everything relating to forestry that I could lay my hands on by buying or borrowing. I may here be allowed to digress, to say how highly I and my fellow-labourers, "Under Foresters," appreciate the boon of your monthly Journal, the arrival of which on the 1st of each month is looked forward to with great anxiety and ever-increasing interest; the contents "devoured" from beginning to end with the greatest avidity, and then perused and conned over at leisure till the next number appears. What a loss it has been to foresters that such a journal was not in existence many years ago! It is not yet a year old, and I must say that I have obtained much more knowledge of my profession, both practically and scientifically, through reading its contents, than I have been able to obtain from all the other books on forestry in existence in the English language. Both I and my fellow-foresters feel that we owe much to the JOURNAL OF FORESTRY, and sincerely wish it a long and prosperous career.

Now to return to my own affairs. In the course of a few weeks I will have completed my "apprenticeship." I have been looking forward with pleasure and an agreeable feeling of lively hope to "bettering" myself by a change to some more extended sphere, where I could see, and be allowed to practise, the most approved arts of modern Scotch forestry; but the letter of "Under Forester" has thrown somewhat of a damper on my hopes, and I am at present quite at a loss as to what plan to adopt to succeed in my (I hope) laudable desire to climb to the "top of the tree" of forestry at a safe, sure, and steadily progressive rate of learning, and consequent moving from place to place in the acquirement of practice and experience.

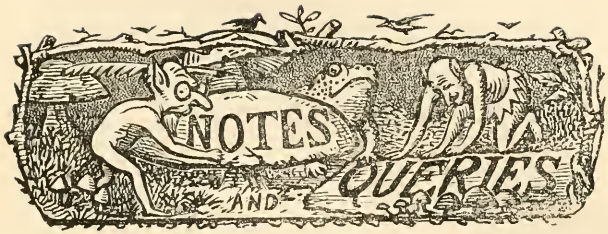
Owing to my master never having been more than a few days at a time

away from the estate he had been so long forester upon, and all his dealings being with local nurserymen, as is the general custom in this district, he has no influence, nor have I, with any nurserymen, or any of the leading head foresters, at more than a distance of a few miles from where I write, so that I am afraid my chances of bettering myself, according to "Under Forester's" statement, are very small indeed. This is a great disappointment to me, but how am I to help it? Am I to wait till an "Under Forester's" suggestions are carried out by the Scottish Arboricultural Society? which I believe meets only once a year; and, so far as I know, has never yet made a movement in the direction so well indicated by "Under Forester," to assist willing and deserving men to push their way on in the world, by bringing them under the notice of the owners of forests and plantations, who are desirous to employ only the most capable and trustworthy men. I cannot understand why such a Society should have been so long in existence without having devised some legitimate plan for accomplishing this most desirable object, which in its own interests it should arrange for at the earliest convenient opportunity; but in the meanwhile I and others cannot afford to lose time waiting upon its tardy arrangements. I would therefore beg of some of the experienced and influential head foresters to give us their opinions upon this vitally important subject in the pages of the JOURNAL OF FORESTRY, so that we younger and inexperienced, but anxious and willing men, or "lads," may have the benefit of their matured experience, and know How and When to set about advancing ourselves, without being obliged to beg a favour of a nurseryman, or having to be under a compliment to a friend, who has probably to strain his influence in our favour to the exclusion of possibly a better man. All that I wish for is "a fair field and no favour," and let the *best* man win; and as I have no desire to assume a knowledge I do not possess, nor a merit I do not deserve, I trust that my elders in the profession will not judge me harshly, but generously treat my appeal for information, and confer a lasting favour on their less experienced brethren by aiding us with their experience in this deeply important matter.

I must apologize to you, Mr. Editor, for what I fear is much too long a letter, but my total inexperience in writing for publication will, I hope, be a sufficient excuse for its length. Its composition will tax your leniency; of its merits and importance you are the best judge.

A FORESTER'S APPRENTICE.

[We are much pleased to receive such an earnest and intelligent letter from so young a member of the profession, and trust it will receive the attention it so well deserves from Foresters of experience. The want of any public institution, such as a School of Forestry would provide, makes it highly desirable that Foresters of all grades should speak out, plainly and clearly, upon the educational and other matters of which "Under Forester" and "Apprentice" so much complain. We shall be pleased to publish any intelligent communications upon the subject.—ED.]



[*The Editor requests the assistance of Readers in answering Queries, so that the usefulness of this Department may be maintained.*]

Roots choking Drains.—I have to thank J. R. for his kind reply, at page 726, to my inquiry upon this subject in your January number, page 659; to which query I beg to refer "Subscriber," to show that his suggestions are not suitable to the case. The water must have free ingress to the drain as it passes through the plantation, which it serves to drain as well as the park above it. I shall carry out J. R.'s very practical plan, as well as another that has been recommended to me by a friend near Derby, who covers his pipes with about 9 inches of small stones, rough gravel, or such like open and hard material, and then covers the whole over with a layer, about 4 inches thick, of the spent lime from gasworks, beaten firm and smooth with the back of a spade. My friend has several drains so treated eight years ago, which have never been opened since, and are working admirably. Previously they had been a great torment by the tree roots getting into and choking them. I will try both plans, and report at some future time.—Inquirer. [Please do.—Ed.]

Privet.—If W. C. L. C., page 658, wishes to get rid of his privet once for all, I would recommend the following as an effectual as well as expeditious plan. Get two strong chains, same as those used for dragging trees, fasten one of them round the neck of each privet bush, apply a horse, and drag it clean out by the root, and then burn it. During the time the horse is away to the fire with one load the men can be fastening the chain on the next bush, so as to keep the horse always moving. Young thorns and all kinds of undergrowth or suckers are hauled out in the same way. I have cleared twelve acres as above, and intend to do many more on same plan. Privet, unless thinly planted in small scattered clumps, is an unmitigated nuisance as cover.—R. B.

Measuring the Circumference of a Tree-stem.—What is the proper distance from the ground at which to measure the circumference of the stem of a tree? Much confusion arises when the circumference is given and the height from the ground not stated. I am not aware of any particular height being the generally accepted or understood point at which to take the girth; and I am sure that many others as well as myself would be glad of information on the subject, if some of the initiated would be so kind as to enlighten us.—Ignoramus.

Black Italian Poplar.—Can you or any of your correspondents say if the tree known by the name of "Black Italian Poplar" is a native of Britain? If not, when it was introduced, and who introduced it.—G. K. D.

[Black Italian Poplar is a native of North America. It was introduced into Britain in 1772 by Dr. John Hope.—Ed. *J. F.*]

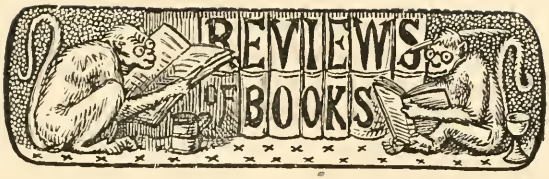
Barb Wire Fences.—I have had my attention called to the "Barb" fence, and heard it stated that four wires of bristling barbs were equal to six of the common wire. Not having had any personal experience with the barbs, I am anxious to know all about them. Will any of your readers who have tried them kindly state for general information if such fences are adapted for sheep?—D. S. S.

Plants to grow under Beeches.—Will some one of your experienced readers kindly inform me what kinds of evergreen plants will thrive under the shade of Beech trees? I wish to cover the bare ground under a fine clump of old Beeches near my house. I have tried various kinds of evergreen shrubs, but from want of experience I am afraid I have not chosen the right kinds. I have planted the ground twice already, but failed to get it covered. Any information on the subject will confer a benefit on —An Amateur.

Barking Standing Oaks.—In travelling through some parts of England—in the West Riding of Yorkshire, for instance—I have observed in the months of June and July, large oaks standing with their heads lopped off, and the stem and main limbs, which were the only parts left entirely stripped of their bark. Would some of your correspondents who have had experience of this system of barking large oaks kindly inform me what advantages are derived from it? How is the operation performed? Is either the bark or the timber rendered more valuable? and do they command a higher price in the market?—Flying Scotchman.

Holly Hedge.—I intend planting a Holly hedge to screen my grounds from the passers-by on a public road. Holly is what I prefer, only it is very slow growing, and I am desirous to inquire through your pages what is the best method of rearing a close and compact hedge, in the least possible time, to a height of six feet. There is rather a large extent of it, about 800 yards, so that plants more than two feet high would be too expensive. I can enrich the soil to any extent if manure is beneficial to the holly, and promotes its rapid growth. Will some of your able correspondents please to answer my inquiries in your next number?—John S. Hall.

The Trees in Paris.—It is estimated that the annual cost of keeping in order the trees, shrubberies, and seats upon the boulevards and in the public squares and gardens of Paris is nearly 2,000,000 fr. There are 8,000 seats for the accommodation of the public. The expense of keeping up all the extra-mural recreation grounds, exclusive of the Bois de Boulogne and the Bois de Vincennes, is rather more than 300,000 fr.



Multum-in-Parvo Gardening. By SAMUEL WOOD. London: Crosby Lockwood and Co.

WE have here set forth, in a nicely got-up little book, the author's idea "How to make One Acre of Land, without Glass, produce, by the Cultivation of Fruits and Vegetables, Six Hundred and Twenty Pounds per annum clear profit"! or rather, to state the exact "net profit" as given in the text, £624 5s. 9d.; all this being produced by an original outlay of the paltry sum of £623 2s.!!—not quite a year's net profit; and, moreover, if the "garden should have an outer boundary wall of brick, then £150 more may be added to the income," but "allowing one-third for losses of one sort and another, leaves a total net amount of £100 for the produce of this outer wall. This leaves us a grand total of £724 clear profit from the garden yearly!"!!! Truly grand, we would say *prodigious!* After this it will surprise no one to be informed "how to grow flowers in three glass houses so as to realize £176 per annum clear profit,"—a comparatively easy matter, although, according to the manner here proclaimed, we doubt if the results have ever in reality been accomplished. If such returns can be practically realized, who would not be a "*Multum-in-Parvo*" gardener? The curious may also find some amusement, and perhaps instruction, in a perusal of the author's peculiar notions about the potato disease and insect generation.

Handbook of Hardy Trees, Shrubs, and Herbaceous Plants. By W. B. HEMSLEY. London: Longmans, Green, and Co.

In a work of this kind, intended as a "Handbook," we generally expect to find it more concise than comprehensive, especially when treating on a subject of such wide range and varied aspect as is included in the above title; but here we have a most comprehensive and lucidly descriptive epitome of nearly every tree, shrub, and herbaceous plant known to be hardy enough to withstand the climate and able to grow in some part of Britain, as well as a vast amount of concise and well-selected remarks concerning their history and uses, with many excellent cultural directions and suggestive hints upon the various tribes of hardy plants, all comprised in a handy octavo volume of less than 700 pages. The principal object of the author has been to supply a handbook of ready reference, something between a mere dictionary of names and a scientific or practical treatise

containing nothing beyond technical or cultural descriptions of plants. With this object in view the author has taken as the basis of his work the "Manuel de l'Amateur des Jardins," compiled by the eminent French authors MM. Decaisne and Naudin, of which work good use has been made by the introduction into this of the original woodcuts, and any available information suited to the circumstances under which hardy plants are grown in Britain. The technical portion of the work is arranged on the Natural System, as near as possible to that in use at Kew, and published in Hooker and Bentham's "Genera Plantarum;" because, although much is said upon the practical cultivation of plants, it is considered more necessary to give greater prominence to the descriptive botany of cultivated plants, a branch of literature which has as yet received but comparatively little attention, especially on a comprehensive scale, from either practical or scientific writers since the days of Loudon's wonderful compilations.

Three-fourths of the entire work is taken up with the description, history, uses, &c., of hardy plants; containing a rich store of useful and interesting facts relative to the trees, shrubs, &c., grown in this country either for use or ornament, many of which we had marked for quotation if space allowed; but we can only quote as an example, taken at random, the description of the genus *Quercus*, or oaks.

QUERCUS.

"Evergreen or deciduous trees or shrubs. Male flowers in loose slender catkin; perianth 5- to 10- lobed; stamens indefinite, with slender exserted filaments. Female flower solitary, perianth 3- to 8-lobed, ovary 3-celled, styles 3. Fruit ovoid or oblong, 1-seeded, situated in a cupule of imbricated scales. There are about 250 species belonging to this genus, none of which occur south of the equator. The name is of classical Latin origin.

"*Q. Robur.* Common Oak.—This is the most majestic of our indigenous trees, though in height it is usually exceeded by the elm and others, very rarely attaining to 90 or 100 feet. There are two extreme forms which have been classed as species, but intermediate connecting varieties have been since discovered.

"*Q. R. Sessiliflora* has petiolate leaves and nearly or quite sessile acorns. *Q. R. Pedunculata* has sessile leaves and pedunculate acorns. This species has a wide range of distribution in Europe and Asia. There are several slight varieties, and a few sufficiently distinct to plant in large collections, such as *pendula*, *heterophylla*, *pectinata*, *variegata*, and *picta*, the latter with pink, white, and green foliage.

"*Q. Cerris.* Turkey Oak.—A very handsome deciduous South European species, of more rapid and symmetrical growth than the native oak. The leaves in the common form are usually smaller and more finely lobed and sharper toothed, and the fruit is not ripened till the second year. The bracts forming the cup or involucre of the long narrow acorn are long, narrow, and spreading. This is the only exotic deciduous species commonly planted, and of this there are many fine specimens in various parts of the country. Although the leaves change to brown in autumn, they persist during a great part of the winter. There are several varieties, including a silver-variegated one, and another with large, almost evergreen foliage, called *Fulhamensis*.

"*Q. Coccinea.* Scarlet Oak.—A highly ornamental species, with large deciduous oblong-oval sinuately lobed petiolate glabrescent leaves about a foot long. Acorn small, ovoid or globular, half immersed in a scaly involucre. This is a handsome, fast-growing large tree of pyramidal outline, and especially conspicuous in autumn, when the foliage changes to a bright scarlet. It is a native of North America, and less valuable as a timber tree than many other species.

"*Q. alba*, White Oak; *Q. macrocarpa*, Bur Oak; *Q. rubra*, Red Oak; and *Q. tinctoria*, Yellow-barked Oak, are other North American ornamental and useful species, but they are almost unknown in this country. *Q. Ægilops*, the Valonia Oak, furnishes the very large acorns imported from the South of Europe into this country for tanning purposes. It is rarely seen, except in a very small state, in this country.

"*Q. Ilex.* Evergreen Oak.—The only species of the evergreen section commonly seen. It is variable in foliage, from narrow-lanceolate to oblong or nearly rotundate, and more or less prickly toothed or quite entire. The acorns are small, and half immersed in a closely imbricated cup. Native of the South of Europe.

"*Q. Suber*, the Cork Oak, is very near the last in general aspect, and is equally variable in foliage, but the leaves have longer petioles, and the bark, instead of being smoth, is deeply furrowed and corky. *Q. occidentalis* is often confused with the true Cork Oak, but the latter ripens its acorns in one season, whereas the former requires two to bring them to maturity."

The other genera are described in similar style. Part Second treats of the cultivation of plants under the different headings of vegetable physiology and economy considered in their relations to cultivation; climate, its influence on vegetation; soils, their nature and composition; and directions for the propagation and cultivation of the various tribes of plants: with the classification of plants according to their duration, habit, &c.; such as *Arborescent* plants, including evergreen trees, deciduous trees with ornamental foliage, conspicuous flowers, variegated or coloured foliage, bright-coloured bark, cut or dissected foliage, and pendulous branches; *Fructescent*, including evergreen and deciduous shrubs, and climbing, trailing, or twining shrubby plants; and the whole tribe of *Herbaceous* plants are classed in the same useful manner, so that any plant or class of plants required for a particular object can be easily found by a reference to the lists.

The first part of the work is profusely illustrated with beautifully-executed woodcuts of the leading plants mentioned in the text, and the book finishes with a very full and complete index of the English and Latin names, with the more important synonyms of the plants described or referred to in Part First. On the whole it is an excellent compilation of its kind, and wonderfully complete for a first essay in a much-required direction. To our readers who wish for a book of ready reference upon all the hardy, useful, and ornamental plants, we can cordially recommend this work, in which they will find both instructive and interesting reading.

Transactions and Proceedings of the Botanical Society of Edinburgh, Vol. XIII., Part I.

Edinburgh: Printed for the Botanical Society.

This annual report of the sayings and doings of one of the most industrious scientific societies of the day contains much concerning vegetable economy and plant life that is of great interest and value to foresters, as well as to all others whose daily avocations require them to study and note the wondrous ways and workings of nature. To possess a botanical knowledge of plants is of the first importance to all who aspire to cultivate them with success—not only to be able to distinguish one species of plants from another, but also to discover and understand their nature, habits, and uses, and to be able to apply such invaluable knowledge with skill and scientific accuracy in the manipulation and cultivation of the vegetable kingdom, so as to supply in the most economic and best possible manner all the necessary wants of man, and to adorn his home with all the glorious beauties of nature in their loveliest form. Under the guidance of a numerous array of able and talented men the Edinburgh Botanical Society has for nearly half a century held a leading position amongst the learned societies of the world, and is probably the most successful of them all at the present day in inculcating a perfect knowledge of botany and vegetable economy to young aspirants, and a true taste for the appreciation and scientific investigation of the marvellous and beautiful intricacies of nature as displayed in the plant world. The annals of the society are a complete epitome of the progress and advancement of botanical science, and contain besides many records of facts and data of the utmost importance to forestry and to all other branches of rural economy.

The part of its annals now before us contains a full average of well-reasoned and deeply interesting articles, both in a scientific and practical sense, as well as a large store of notes and comments upon current topics and events relative to the vegetable kingdom during the past season. The Transactions, which occupy the first 114 pages, begin with some able remarks upon "The Influence of the Sea on the Distribution of Plants," by Vice-President Alexander Buchan, M.A., F.R.S.E., being an address delivered at the opening meeting of the session in November, in which he forcibly points out the great value of such an inquiry, not only for the light it would cast on the distribution of important classes of plants, but also the indirect light which it is likely to throw on the influence of the sea on man himself. The same eminent meteorologist has another most instructive paper in this part on "Low Night Temperatures in Relation to Slight Inequalities of Surface," in which he describes in the clearest manner the great difference, in special instances, of the night temperature on hillocks and in hollows adjacent to each other, with the practical deduction, which we quote for the benefit of our readers, that "to secure the best protection for tender plants in spring, when a night's frost may be productive of ruinous loss, a gently sloping surface should, if possible,

be selected. But if there be no choice, and the plant-beds must be made on a level piece of ground, let the beds slope slightly from the centre line on both sides to the trenches which separate them. Let the trenches or paths, furthermore, be kept free from grass, weeds, leaves, and other litter, which being bad conductors of heat, will only retain and store up the cold of radiation; and let care be taken that the earth of the trenches be not kept loose by raking, but be beaten or trodden into as firm a mass as possible, so that the heat of the soil may the more readily be conducted to the surface to counteract the cold rapidly increasing there through the effects of nocturnal radiation."

The second paper in the Transactions gives an interesting account by W. Lauder Lindsay, M.D., &c., of "Recent Contributions to the Flora of Iceland."

In the third paper an excellent account is given of many fine and rare specimen trees and plants growing in the open air in Dr. Shapter's garden, Cobham, near Exeter, accompanied by a beautiful engraving, in which is shown an elegant plant of *Cordyline Australis*, 17 feet high, with a circumference of stem of 2 feet; and a magnificent specimen of *Cupressus macrocarpa*, upwards of 51 feet high, beautifully furnished and tapering gracefully from bottom to top, a perfect spire. The garden and district is rich in other rare and noteworthy trees and shrubs, and will well repay a visit from any one with a taste for arboricultural objects.

An instructive paper (4) follows, by A. Stephen Wilson, on "Experiments with Turnip Seeds," which will be read with equal interest by vegetable physiologists and agriculturists. Number five is an exceedingly interesting physiological paper on "Vegetable Digestion," by J. Bayley Balfour, M.B., F.L.S., in which he supports with great ability Professor Morren's (of Liege) well-known views on the subject, and the analogous functions peculiar to the so-called carnivorous plants.

A capital paper (9) by John Sadler, F.R.P.S., describes in an instructive and interesting manner the "Alpine Flora of Ben Nevis, Inverness-shire," to which famous mountain the Scottish Alpine Botanical Club paid a visit in the month of July, 1876. Even in that semi-tropical month "the summit of the mountain was reached amidst sleet and rain, thick mist, and a fierce cold wind, which unfortunately prevented us from seeing one of the most extensive prospects in Scotland. On a clear day are seen mountain ranges in all directions, intermingled with extensive water surfaces; the view ranges from the Moray Firth and the mountains of Ross and Sutherland in the north and north-east to Ben Lomond and the island of Colonsay in the south and south-west, comprising a distance of about 180 miles. The scene can scarcely be equalled, or at least surpassed, in the diversity of magnificence and striking objects, in majesty and grandeur."

For many years a valuable report has appeared in the Transactions of the Society on "The State of the Open-air Vegetation at the Royal Botanic Gardens, Edinburgh," at certain periods of the year, by the able

curator, Mr. James M'Nab, who brings long experience and matured knowledge to bear on this most important branch of botanical science.

The admirable summary given by him in the tenth paper of the state of vegetation at the various periods reported in 1877 is highly instructive and must be of great assistance to many in their choice of hardy trees and other plants, especially such as are suitable for decorative purposes.

Of the remaining four papers in the Transactions, viz., six, on "New Pezizæ at Inverleith House" (illustrated); seven, on "Fossil Plants from the Calciferous Sandstone around Edinburgh;" eleven, "A Six Weeks' Botanical Tour in the Levant;" and twelve, "Notes upon some Plants of the British Herbarium at the Royal Botanic Garden, Edinburgh," we may say that they are of great interest to all botanical students.

The Proceedings of the Society, which occupy twenty-four pages, and contain a great variety of most interesting notes and other memoranda of papers read, plants and other articles exhibited, and the discussions which take place at the meetings, finishes with some "Statistics of the Edinburgh University Botanical Class for 1877," from which we learn that the number of pupils during the session was 389; the number of lectures given being 66, the number of practical demonstrations 55, and the number of fresh specimens of plants used to illustrate the lectures being 48,820. Botanical excursions of the students are a special feature of the Edinburgh University. During the session 541 of them availed themselves of the excursions to various parts of the country, traversing over 500 miles, and collecting 676 distinct species of plants, which shows an amount of industry and enthusiasm quite unequalled by any other university in the country in the pursuit of botanical knowledge.

Heavy and Light Woods.—The woods that are heavier than water are Dutch box, Indian cedar, ebony, lignum vitæ, mahogany, heart of oak, and pomegranate vine. Lignum vitæ is one-third heavier, pomegranate rather more. On the other hand, cork, having a specific gravity of ·24, and poplar of ·383, are amongst the lightest of timber products.—*D.*

The Fruit of the Service Tree.—Large quantities of these are sold in the streets of Constantinople during the autumn, under the name of *Kiziljicks*, *i.e.*, Little Reds. They are plucked before they are ripe, that is to say, when they are bright red. The first time I tasted them, thinking from their appearance that they were cooling and luscious, I crammed a coupleinto my mouth expecting a treat, but was soon undeceived. In their unripe condition they are the very concentration of all that is acid and astringent, so much so that a Turkish mother will call her peevish crying baby a *Kiziljick*. Their flowers must be something like that of the fruit Tamarind, so graphically described by Mark Twain, for my mouth, like his, assumed the form of the stalk end of a Tomato, and preserved it for several hours. With a certain amount of sugar they make a deliciously refreshing drink for use in hot weather. They are eaten in large quantities by all the Ottomans, both Christian and Moslem, as an infallible preventive of diarrhœa. Plucked when they are just losing their bright red hue they make an excellent preserve, which the Greek and Armenian housewives consider to be valuable.—*C. Q. W.*

Woods and Woodlands.

LECTURE BY PROF. WILLIAM H. BREWER, CONNECTICUT, U.S.A.

Communicated by Burnet Landreth, Chief of the Bureau of Agriculture, Philadelphia.

SAVAGES may live and thrive in a forest-clad country, but civilized man needs something else. For civilization is built upon agriculture, and this means tillable soil, open fields and meadows, and sunny pastures. For this, land must be cleared if originally forest-clad, and along with the necessary destruction of trees and wood there inevitably comes waste, until at length new forests must be either planted or old ones protected and fostered. This is not a mere local fact: it is a great law, as true of the Old World as of the New. Most of the countries of Europe have gone through a history in this respect much like ours, only that scarcity of timber in some, and anxiety about the future supply in others, began to be felt centuries ago, while we are just beginning to feel it.

In all European countries from which our ancestors came, and from which we derived our civilization, *forests* were in early times legally more than mere woodlands; they were essentially *hunting-grounds*. While the laws were similar over the most of Europe, those in England will be best to illustrate this. In England the various forest laws were scattered through many documents until they were collected by Manwood, an eminent legal writer, and published in a separate form in 1598, entitled "A Treatise and Discourse of the Lawes of the Forrest," a book still an authority on the laws as they then existed. A few extracts may be instructive to us now: "A Forrest is a certen Territorie of wooddy grounds, fruitfull pastures, priuiledged for wild beasts and foules of Forrest, Chase, and Warren, to rest and abide, in the safe protection of the King, for his princely delight and pleasure. . . . For the preseruacion and continuance of which said place, together with the vert and Venison, there are certen particuler Lawes, Priuiledges and Officers, belonging to the same, meete for that purpose, and are only proper unto a Forrest, and not to any other Place." And again he says, "And therefore a Forrest doth chiefly consist of these foure things, that is to say, of vert, venison, particular lawes and priuiledges, and of certen meet officers appointed for that purpose, to thend that the same may the better be preserued and kept for a place of recreation and pastime, meete for the royal dignitie of a Prince." The officers chosen to the above work were called foresters, and at first their function was to protect the game and later the wood. This was a very old calling, and in some countries on the Continent was of the character of an hereditary office. Learned genealogists tell us that a thousand years ago there were no family or surnames, and that they came

in first as noble names, usually associated with landed possessions or noble offices; and an authority says, "Of these ancient patronymics, probably the *most ancient* one which has descended unchanged to the present time is that of Du Bois," and that the only other of equal antiquity in the records of the Imperial (or National) Library of France is Pierrepont, the first being the "Grand Masters of the Forests of France," and the other the "Grand Masters of the Waters of France." In early times the forests were the king's, and so was the game, which was so carefully preserved that it has been said that "to kill a king's deer was a greater offence than to kill a king's subject." He could grant a forest to a subject, as was often done, but this grant did not carry ownership as we now understand that title, but merely "all the Deere and game are included, but nothing else." Even more, where private ownership of lands was recognised, the same authority I have been quoting (Manwood, 1598) says that "the lawes of the Forrest do restraine euery man from cutting doune of his woods within his own freehold in the Forrest." What wood was to be cut or gathered, where it was to be cut, by whom and in what manner it was to be cut, were regulated by the most elaborate and stringent legal enactments. To be sure the *game* was the most important part legally. Manwood says, "As a Forrest hauing neither beast of Venerie, nor beast of Chase in it, is no Forrest at all, but a void and unproffitable peece of ground," yet the wood was cared for as already mentioned. The *vert* in the above quotations is defined by the same legal authority to be all the trees and underwood, and all the vegetation which could harbour, shelter, and comfort the game, so that later English law came to consider it as meaning "everything that grows and bears a green leaf within the forest." All this was protected by law, administered by numerous officers.

However curious it might be to follow this up, or interesting to you to hear further extreats from the quaint old volume, time forbids further notice. I have introduced it to show and illustrate how useless is much of the complaint that we hear made against Americans for their destruction of woods and woodlands, for in all the countries of Europe, despite the legal restrictions, the numerous officers to protect woods, and the careful administration of the laws, the forests dwindled just as ours have, until their present needs must be largely met by artificial planting. If their forests were destroyed despite all the care and preservative enactments, it is surely not wonderful that a similar or even worse destruction goes on here, where such restraints are almost unknown.

During the century following our first settlement, the eastern United States were colonized by representatives of several European countries, who brought their traditions and customs, and, to a certain extent, their laws. The laws relating to lands were essentially those of the various mother countries; but as regards the character of the woodlands, the New World differed greatly from the Old. There, the forests were not so heavy, and were composed of but few species of trees, Great Britain having only twenty-nine indigenous species, France but thirty-three or thirty four, and all Europe west of Russia scarcely fifty. But in the American colonies

were forests of vast extent, composed of a great variety of trees, twice as many species being found in one of our States, like Pennsylvania or New York, as are found in the whole of western and central Europe, or from the Bay of Biscay to the Black Sea, and from Lapland to Italy. Moreover, the timber was of greater size, and the variety of character greater. We had whole genera of trees, of hard woods like hickory, soft ones like the tulip-tree or cucumber, and fragrant ones like the sassafras, which were unknown in the Old World. This prodigality of resource almost invited waste. To save woods and timbers to the common mind seemed about as useless as to be saving of the waters of the sea. The prudent and careful, however, foresaw quite early that ultimate want would come, and legal efforts were put forth from time to time to restrain the waste. I know not how early this began, but in the "Documentary History of New York," is a paper to the effect that, "Att a meeting held this 29th day off Aprill, 1699, in Breucklyn, Benjamin Vande Water, Joris Haussen, and Jan Gerritse Dorlant" were chosen officers to consider the "great inconvenience and lose" that the inhabitants of the town suffered because that unauthorized persons "doe ffall and cutt the best trees and sully the best woods," &c. Laws were then passed and penalties affixed for wasting the timber on the public lands, and from that time to this there has been much talk and many laws to restrain waste. Our forests have decreased, nevertheless, and you know the result.

In this State, all the lands long ago passed into the private possession of its citizens, and under our laws legal ownership has long carried practically complete ownership, not only of the soil, but of the minerals that lie in it, and whatever grows upon it. And therefore our timbers were cut whenever it seemed to be of immediate profit to the owner. We have practically no traditions of the dearth of wood, nor of the advantage, much less the necessity, of providing for the needs of future years. During the first half century of our national independence, the agricultural importance of this State was much greater relatively than now, when railways have placed the fertile West in active competition with our less generous soil, and much land which paid well as agricultural land forty years ago, is now of *relatively* vastly less value, and I verily believe that we have much land in the State which would to-day be three, four, or even five times more valuable as *timber* land than it is now as nominal "cleared" or "improved" land.

According to the census of 1850, there were in this State of Connecticut 2,383,879 acres in farms, of which 74·2 per cent. was described as "improved." In 1860, the amount in farms had increased to 2,504,264 acres, of which 74·1 was called "improved," the relative amount varying by but one-tenth of one per cent. At the next census, in 1870, the amount in farms had fallen off again to 2,364,416 acres, of which 69·6 per cent. is returned as "improved," and 577,333 acres, or 24·4 per cent. is returned as *woodland;* in other words, that still very nearly one-fourth the aggregate area of our farms is in woodlands—surely a very considerable area; but of course the percentage is less if computed of the whole State

domain. It shows, moreover, that in those ten years the area of woodland increased somewhat.

We have about seventy-five or eighty species of native trees in New England, of which about sixty occur in this State. Of these last, about forty species are large or medium-sized trees; then we have smaller ones, as the prickly ash, crab-apple, &c., and some species, as the sassafras, is rather small here, but grows much larger west of the Appalachian Mountains. Mere shrubs, like the laurel, alders, huckleberries, &c., are not included in the above sixty species.

I may here say that the United States, as a whole, is very rich in tree species; the wood of over four hundred indigenous species was exhibited at the International Exhibition the past summer, embracing thirty-seven species of oaks, thirty-four of pines, seventeen of spruce and fir, eleven maples, eight poplars, &c. Of timber trees we have a goodly number of species.

We may class our forest products under five general classes or groups.

1st. Fuel. 2nd. Woods of construction, that is, heavy timber for buildings, bridges, wharves, piles, ships, railroad ties, &c. 3rd. Woods for furniture and joiner work. 4th. For miscellaneous manufactures, as wooden ware, carriages, cars, machinery, tools and implements, &c. 5th. Other miscellaneous forest products, as bark, tanning materials, gums, resins, nuts, &c., all of which we can produce.

The value and character of the useful product varies as much with the soil, exposure, and other conditions, with forest productions as with agricultural productions. Thus the rapidity of growth, the strength, beauty, hardness, toughness, and durability varies greatly with the soil, moisture, and exposure. In a general way, we may say that woods of "second growth" are tougher than of the original forest growth, and woods grown on moderately dry soils are more durable than the woods of the same species growing on soils too wet or too dry. Again, trees which have had a sunny exposure during growth are better than when grown in much shade, and the ship-builders along our coast prefer timbers that have grown within sixty miles of salt water.

Much has been said and written of late years about tree planting in our country; it has been a prolific theme at meetings, at fairs, and in the papers; it has been considered from many points of view—from the ornamental and æsthetic side, the useful side, and the sentimental side—and yet I am sorry to say that I cannot offer you much knowledge of a definite kind as to the *best trees for us to plant.*

Now here let me digress again. I have alluded to forest and foresters in the Old World, in earlier times, and how that the foresters protected the game and their coverts. From this they came to protect the woods and timber for its own sake, and as these became more and more scarce, and trees began to be planted for *use* as well as ornament, they naturally were the persons who experimented on this. Governments and noble landed proprietors aided, and slowly forestry assumed the character of a science as well as an art, until at the present time the most of the wood of the more populous countries of Europe is as much a cultivated product

as are the grains of the field; forestry is as definite a branch of industry as agriculture; there are schools to aid it, professors to teach and experiment in it, and there is now an enormous literature relating to it, vastly less, however, in English than in the Continental languages. The timbers and woods of each country have been enriched by numerous exotic species. In the place of scarcely a score of useful species originally in Great Britain, there are now very many, and in France some seventy or eighty are comparatively common. As one of the judges of forest products at the late Centennial Exhibition, I had a better opportunity than ever before to see what had been done in forestry abroad, and to see the results of liberal education in these matters. In nearly every country of Europe (except Great Britain) there is government aid; in some forestal engineers are educated by the government, as army and navy officers are, experiments are recorded, and, as I have before said, there is an abundant literature relating to nearly every department of the subject As a single illustration of this, one of the Spanish Commissioners to the Centennial Exhibition, Sr. José Jordana y Morera, a forestal engineer of that country, has prepared and published a list of the publications relating to forestry published in the Spanish language alone, and they amount to over 1,100 titles.

Now just here let me say again that in each country of Europe not only are the indigenous trees planted, but all available exotic species have been tried, and new species are continually on trial. *What species are to be ultimately successful* (that is, profitable) *in cultivation, can only be determined by actual experience.* I wish to impress this upon your minds. No science or "practical" skill can predict before trial what trees are to flourish successfully, what merely live, and what utterly fail. This is one of the secrets of nature, only to be brought to light by experiment and trial, and by the experience of different places collated and compared. This work has been going on so long in Europe that many truths are practically settled, and some trees so thoroughly established that they are as profitable as the original natives. For instance, what we call the "English Larch" was originally not English, nor even British; it was introduced into Great Britain from the Continent, and is now so extensively grown that the great majority of Englishmen probably have no suspicion that it is of foreign origin. It is now considered the most profitable species introduced into that country from elsewhere. About forty years ago, Loudon, after a careful study of the matter, thought that 1,400 species of foreign trees and shrubs had been introduced into Great Britain between 1548 and that time, 1838; and since then the number has probably been nearly doubled. How many of these are mere shrubs, and how many large enough to be called trees, I have no means of judging; but doubtless some hundreds are truly trees. Of this large number only a comparatively few have proved profitable for cultivation on any considerable scale for useful purposes, as distinguished from ornamental. Of many of these species the experiment is still going on, and we do not yet know whether or not their cultivation will prove profitable as timber trees or as fuel.

Mr. Gladstone and Tree-Felling.

SOME further experiments took place on Saturday, February 2nd, on the Roupell Park Estate, close to Tulse Hill station, with Ransome's Patent Steam Tree-feller, which has already been described in these columns. More than ordinary interest attached to the proceedings from the fact of Mr. Gladstone having expressed a desire to be present to witness the testing of the invention. In spite of the weather being anything but inviting, the right hon. gentleman, who was accompanied by Mr. W. H. Gladstone, M.P., kept his appointment, and was received very warmly by a considerable gathering of ladies and gentlemen, and with loud cheers from the workmen round about. The tree-feller had been operating before the right hon. gentleman's arrival, a row of oaks and elms which lay on one side of the meadows attesting its capabilities. When Mr. Gladstone reached the scene, the tree-feller was carried by four men to the base of a solid young oak, between two and three feet in diameter. All the fixing it received was a man thrusting a crowbar into the ground behind to steady it; while a second steadied the saw-blade at the free end with his hands until a few strokes gave it a bearing in the trunk of the tree just clear of the ground. The operation of the saw-blade was precisely analogous to that of a carpenter using a ripping saw to cut a sapling close to the ground. In four minutes after steam was turned on the tree fell, and a measurement of the section gave a diameter of 3 ft. 1 in. in the widest part, and of 2 ft. 3 in. in the narrowest. Mr. Gladstone watched the process with a critical eye, and declared that he had been most interested, but that the machine was susceptible of larger application in other countries than in this, Scotland even offering a better field for its operations than England. On being asked by a bystander how long such a tree would take an expert woodcutter to fell, the right hon. gentleman said he thought it would be very nearly a day's work; but on this point he consulted his son, who seems to have inherited the paternal taste for felling timber. The hon. member for Whitby did not think it was quite a day's work. Then the right hon. gentleman explained to a little circle of interested auditors, in response to queries, or by way of comparing notes with one or two experts amongst them, that from the severity of the labour six hours' continual wood chopping was a very good day's work. There would be great economy of timber from the use of the machine, as it cut close to the ground; whereas a man must have a "face" of at least a foot. His own experience was that oak, though very hard, was not a bad tree to cut, for the grain broke off easily, and did not cling to the axe. Beech was far tougher, that and ash being the two most difficult to fell of our English trees, on account

of their bending to the axe. Ash was subject to fracture in felling, and he had a splinter of ash that had broken off in this way, in his own experience, 2 ft. 8 in. in length. The pleasantest timber to cut was Spanish chestnut, because it came away so freely, the grain breaking easily. Yew was the most horrible thing to cut of all forest trees. Of holly he had no experience, beyond a specimen 20 in. in diameter.

A second oak, 3 ft. 1 in., was cut with equal facility; then an elm; and, finally, the largest elm on the ground, a tough, gnarled trunk, 5 ft. across the largest diameter, and 4 ft. in the smallest. From the stoker allowing the steam to run down, a stoppage took place in the middle, but the actual cutting time was about sixteen minutes. From a calculation of the area of the cut in the trees that had been felled, and the times taken, it came out that the machine cut at the rate of two superficial feet per minute, on which Mr. Gladstone expressed the opinion that, as from his own observation a man's rate of working would be the same area in an hour, the machine then being tested did as much work, when cutting, in a minute as a man in an hour.

Use of Dynamite for Agricultural Purposes.

A SERIES of very interesting experiments with dynamite took place recently at Enville Hall, the seat of the Earl of Stamford and Warrington. The earl and countess were present, with numerous visitors to witness the experiments, which were conducted by Messrs. Johnson and Co., of Dudley, agents for Nobel's Explosive Company.

Since the introduction in 1871 of dynamite as a powerful blasting agent it has been extensively used for agricultural purposes. Landowners and farmers who have been bothered with huge boulder stones and tough roots have been pleased to obtain the assistance of the new agent as a remedy for removing them. The recent heavy gale, which seems to have swept in a line throughout the country, has proved very destructive to estates thickly timbered, uprooting some thousands of fine trees; indeed, it is roughly estimated that at least half a million, including oak, ash, elm, beech, poplar, and lime, have been toppled over, and on one estate as many as 350 valuable trees have been thrown down. Since the gale dynamite has been continually brought into action for the purpose of removing these obstacles from several estates, amongst which may be mentioned Aqualate Park, Brewood Park, Wingfield Park, Prestwood Park, Enville Park, and many others. The high wind seems to have been so very severe in some parts as to blow the trees down wholesale as it were, the root and its smaller fibres with earthwork weighing some tons coming out of the ground in a mass, thereby making it still more difficult to smash up, a greater quantity of explosive being needed to complete the job.

On the Enville estate the number of roots blown to pieces was 64, amongst which were some very large and tough ones. An experiment had previously been made by digging a hole and burying the root, but this proved a very tedious and expensive method, besides which the firewood was forfeited.

The first experiment consisted of four very large elm trees in the hedge-row. An auger hole 1½ inches in diameter was bored in each and charged with eight dynamite cartridges; the whole were exploded, shivering the roots into fragments suitable for firewood.

The second experiment was made on two large oak trees in the centre of a field. These were simply charged with a few cartridges of dynamite being placed in a natural crevice of the root without an auger hole; the charges were exploded, and the root blown into convenient pieces about the field, suitable for loading up.

The third experiment was made on an extraordinarily large ash in a hedgerow, the fangs of which were very large, and lying undisturbed in the ground, causing a serious obstruction to the plough. Underneath this and between the ties several crowbar holes were made and charged with dynamite, the fuses were all cut the same length and fired simultaneously, blowing the whole mass out of the ground.

The remainder of the roots were treated similarly, except that many were broken up and blown out of their resting-place without an auger hole, by placing dynamite in crevices or natural fissures of the stump.

At the conclusion of the experiments, which lasted some few days, his lordship said they had proved perfectly successful and quite satisfactory. Mr. Robert Cocks, his lordship's principal estate agent, supplementing this by saying that from what he had seen of dynamite he considered it much safer than gunpowder.

Extent of Forests and Prices of Timber in Scotland Sixty-six Years ago.

By D. McKENZIE, Forester, Murthly, Perthshire.

These are collected from a work by Sir John Sinclair, Bart. (1814), being embodied in a general report on the agricultural, &c., state of Scotland at that date, and may be of some interest by way of comparison with the extent of woods and the prices of timber at the present day. The total extent of woods in Scotland has not increased since then, but rather diminished, the area under wood in 1874 being about 860,000 acres. Some of the counties have added, others diminished the extent under wood.

It will be seen from the annexed table that 412,226 acres are *planted woods*, while 501,469 acres are *natural forests*, and no doubt comprising various descriptions of timber trees; but of the extent of natural forests at the present day there are no data for ascertaining with any approach to certainty, but they have undoubtedly greatly diminished in the counties of Inverness, Moray, and Aberdeen. The forests of Rothiemurchus, Duthill, Abernethy, and those on Deeside are now but mere phantoms of what they formerly were, although they still make up the average in the Board of Trade returns. No doubt, part of these tracts have been replanted, and will in due course produce profitable timber. There is yet much to be done by way of planting in these districts, which are admirably adapted for the profitable growth of timber, especially Scots fir.

TABLE I.

The following list of prices of timber extend from 1789 up to 1810. The port of Leith seems to have been the *mart* for timber in those times, and the under-noted are the "average prices" at the different dates and places:—

PORT OF LEITH.	1789.		1799.		1809.		1810.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Oak, per cubic foot . .	1	9	2	10	4	9	4	9
Ash „ „ . .	1	2	2	2	3	3	3	3
Elm and beech „ . .	1	2	2	0	3	3	3	3
Memel fir „ . .	1	0	2	4	4	6	5	0
Common fir „ . .	0	8	1	8	2	8	2	0
American logs „ . .	—		—		—		4	0
Scotch oak bark per ton							£12	0 0
Danish do. do.							8	0 0
English (best) do.							18	0 0

CLYDESDALE.—Prices per cubic foot.	1797.			1805.	
	s.	*d.*		*s.*	*d.*
Lime tree	1	4	...	2	0
White poplar . . .	1	4	...	2	0
„ birch . . .	1	0	...	1	0
Holly for veneering . .	5	0	...	1	0
Horse chestnut for do. . .	—		...	3	0
Cherry or Gean . . .	1	6	...	2	0

			s.	*d.*		*s.*	*d.*
WEST LOTHIAN, in 1810,	Oak .	from	3	0	to	5	0
	Ash and elm	„	2	0	„	3	0
	Plane „	„	2	0	„	2	6
	Beech „	„	1	6	„	2	6 and 4s.
ROXBURGHSHIRE, in 1708,	Oak	„	2	6	„	4	0
	Ash and elm	„	1	3	„	2	0
	Birch, plane, lime, and firs	„	0	6	„	1	6

Ross and Cromarty, in 1805,		s.	d.		s.	d.
Fir, plane, and lime . . .	from	1	0	to	1	3
Ash and elm . . .	„	3	6	„	4	0
Beech and oak (good timber)	„	4	0	„	—	

In Sussex and Devonshire oak bark sold at from £14 to £15 10s. per ton, in 1810.

Table II.

Extent of Woods and Forests in Scotland in the Year 1812, from Old Statistical Accounts, 1814.

County.	Scotch acres. Planted.	Scotch acres. Natural.	Total. Scotch acres.
Aberdeenshire	50,000	74,000	124,000
Forfarshire	33,624	5,604	39,228
Argyleshire	4,000	30,000	34,000
Ayrshire	26,000	6,000	32,000
Banffshire	12,000	6,000	18,000
Berwickshire...	5,500	500	6,000
Caithness-shire	250	600	850
Clackmannanshire	2,000	900	2,900
Cromarty and Ross ...	5,000	72,000	77,000
Dumbartonshire	4,000	7,000	11,000
Dumfriesshire	28,000	3,000	31,000
Edinburghshire	14,000	3,000	17,000
Elgin and Nairnshire ...	14,000	29,000	43,000
Fifeshire	18,000	—	18,000
Galloway	4,400	3,800	8,200
Haddingtonshire	4,500	400	4,900
Inverness-shire	10,000	45,590	55,590
Kincardineshire	17,000	609	17,609
Kinross-shire	1,993	—	1,993
Lanarkshire	4,430	2,150	6,580
Linlithgow, or West Lothian	5,000	200	5,200
Peeblesshire	2,000	500	2,500
Perthshire	50,970	118,930	169,900
Renfrewshire	4,000	500	4,500
Roxburghshire	4,682	608	5,290
Selkirkshire	2,000	—	2,000
Stirlingshire	10,000	4,000	14,000
Sutherlandshire	1,173	3,000	4,173
The Western Hebrides ...	5,000	—	5,000
Scotch acres	343,522	417,891	761,413
English acres	412,226	501,469	913,695

Preserving Timber.—The sleepers or ties of railroads are more exposed to decay than timber in any other position, being fully open to the weather above and to the earth beneath. Their durability is greatly increased, however, by embedding them in gravel with perfect drainage. They will last from twice to three times as long thus protected, by clean, dry, coarse gravel, as when laid in wet clay. This fact shows the importance of providing drainage for fence-posts, the portion of which at the surface of the ground is nearly as much exposed to decay as railway sleepers.

American Forest Trees.—Within ten years, says the *Polytechnic*, no less than 12,000,000 acres of forest have been cut down or burned over in the United States. Much of the timber is used for fuel, twenty-five cities being on record as consuming annually from 5,000 to 10,000 acres each. Fences use up much timber, and railway sleepers require the product of 150,000 acres per annum. The amount of pine and lumber timber yet standing in the forests of the timber states is estimated at 225,000,000,000 feet. The sum of 144,000,000 dollars is invested in the timber industry, employing 200,000 men.

Fall of an Old Oak.—On Sunday evening, Dec. 30th, the fine old oak tree in front of Hornby Hall, near Lancaster, decaying for a great number of years, fell with a fearful crash, and quite alarmed the inhabitants of that quiet part of the village. Some idea of the size of this tree may be gathered from the following dimensions, namely:—Circumference at the bottom, 21½ ft., and 10 ft. from the base, 14 ft.; at 18 ft., 9½ ft. Total length, upwards of 60 ft. The exact age of the tree cannot be ascertained, but it appears from a document in the possession of John Murray, Esq., that 140 years ago it was a stately tree, and even within the memory of the oldest inhabitants its vast arms spread over and nearly covered the field in which it stood.

Tree Planting in California.—Tree planting is receiving much attention in the far west, and California appears to be going ahead in this useful pursuit with her accustomed energy and success. The "blue gum" of Australia (*Eucalyptus globulus*) seems to be the favourite tree with extensive planters, Mr. James T. Stratton, of Almeda County, having had planted more than a year ago 130,000 trees of it, and the Central Pacific Railway Company 50,000 as a first instalment of a million they intend to plant along the line they own, their immediate object being to increase the humidity of the region and lessen the liability to droughts. Other railway companies and private individuals throughout the State are also planting largely the same valuable tree, which promises to become in sub-tropic countries as useful and remunerative to the inhabitants as are the fir, larch, and pine in more temperate climes.

The Goat Moth.—This insect, there is little doubt, continues to spread in the neighbourhood of London—a whiff of the strong goat smell, to which it owes its name, striking the sense in very many plantations in the western suburbs. We may note that the more we know of it, the greater the number of trees we find it attacks. We have noted the oak among the various trees that it attacks. The cases, however, in which the oak suffers are comparatively rare, and we therefore mention a striking instance of a whole row of bleached and barked dead oak trees which we saw some time since in a field not very far from Redhill, which owed their death entirely to the attacks of this insect, as was evident from scars on the wood. They were pointed out to us by Mr. John Clutton, on whose property they stood; and he was good enough to cause another to be cut down at some distance, which was also dying under the attacks of this insect.—*A. H. in "The Gardener."*

Ornamental Berried Trees.—Now that wild flowers are so scarce, what few we have at this time of year being completely obliterated by the long-continued rains, it is pleasing to see amid so much green something that will fix the eye. Few objects can vie with the bright coral-red berries of the rowan tree, or mountain ash (*Pyrus aucuparia*); its fine umbrageous head of fern-like foliage, from the points of its shoots bearing its clusters of berries, far more enduring than flowers, attractive objects in shrubbery, park, and forest scenery, such as ought not to be neglected in making provision for when planting time arrives. It will grow anywhere, its upright and weeping forms, with the yellow-berried, deserving a place in the most select arrangements of trees of moderate growth. Also very conspicuous just now, as they have been for many weeks, are the bright scarlet berries in massive bunches of the scarlet-berried elder, which, seen at any distance among green foliage, are very showy and effective, especially if in front be a good breadth of Darwin's barberry, its clusters of shining deep purple berries having in contrast with the scarlet of the elder a fine effect.

Laburnum Poisoning.—Mr. A. M. Roberts, writing from Epping Forest to the editor of the *Lancet*, gives an instance, which came under his immediate notice, of poisoning by laburnum berries. A little boy of five years old, after taking a hearty meal an hour before, was known to eat some of these berries. An hour afterwards the child commenced to vomit, and at intervals complained of drowsiness, the skin being cold and clammy, the pupils contracted, and the pulse very high. An emetic quickly acted, the vomit consisting of bread, mucus, vegetable matter, and water. An hour later the drowsiness increased, and the pulse had risen to 130. At this stage of the poison coffee was given, which was immediately vomited; it required the exertions of all present to keep the child aroused; the skin was very cold and bathed in perspiration, and the pupils were widely dilated, and not sensitive to light. After a hot bath and hypodermic injection of caffeine he began to recover, and at midnight the child was awake and lively, and next morning he was in his usual health. Mr. Roberts considers that, but for the presence in the stomach of a large quantity of food, the results would have been much more serious.

The Decay of Trees and Shrubs in Suburban Gardens.—This is a subject that cannot fail to strike the attention of any observant person interested in gardening matters. Signs of this decay are by no means uncommon in gardens in the suburbs of London. The atmosphere is generally held responsible, but it is a much more innocent agent than is generally supposed. Imperfect

planting—*i. e.*, planting carelessly in unsuitable soil—is one main cause of this decay. Another and perhaps more prolific source of death consists in periodically raising the level of the soil about the trees by adding fresh surface soil every year. This is done to give a fresh and orderly appearance to the garden, but the result is to remove the roots of the trees and shrubs farther and farther from the sunshine and atmospheric influences. That deaths should occur is not to be wondered at. If it be necessary to add fresh soil, the old surface soil should be first removed and the fresh added; the level will not be elevated beyond its former height, and the plants will be greatly benefited by the dressing.—*Gardener's Chronicle.*

Large Wild Cherry-Tree.—It is stated by J. B. of Bradford Abbas, Dorsetshire, in *Science Gossip*, that a grand specimen of the Wild Cherry (*Prunus avium*) exists within a field upon his farm of the following dimensions—

2 feet	from the ground,	21 feet	in circumference.	
3 „	„	15 „	„	
6 „	„	21 „	„	
10 „	„	19 „	„	

At 12 feet up the branches begin to fork; and one of the principal arms had the misfortune to be broken off during the hurricane that swept across the west of England on the 14th of last October.

Timber for Carriage Building.—"To obtain good results, only the best timber, thoroughly seasoned and free from knots, should be used, and great care should be bestowed on its selection. Nothing is of more importance than this, for it is waste of money throwing away labour on bad or indifferent materials. The English hedgerow ash is well adapted for those parts requiring great strength and solidity, such as the frame of the body, &c. For the panels Honduras mahogany is best, but it should be chosen of straight grain, and as free as possible from all those markings which are so eagerly sought by the cabinet and furniture makers. It is found that such markings cause blemishes, owing to the action of the sun drawing them, as it were, through the paint and varnish. Mahogany is easily bent to any required shape, and retains the form well, qualities which render it of great value to carriage builders. American hickory, birch, and pine are also much used by carriage manufacturers—the first for wheels, and the other two for various purposes. American-made wheels are in great demand, and cannot be surpassed for lightness, strength, and excellence of workmanship. English oak is very good for spokes, and for the stocks or centres elm is excellent, and for these purposes both woods are extensively used." The above I have come across in an old scrap-book of a once famous whip, and as you are noticing coach-building, it may be interesting.—*J. L., in "Land and Water."*

Boxwood.—In some parts of Persia boxwood grows in abundance, particularly in the district of Tenekaboun, in the province of Mazenderun. Upwards of £27,000 worth of this wood was purchased at Rostow, in 1875, by a Liverpool firm, and the great profits made by some individuals have induced many people to engage in this trade. Boxwood was formerly cut down in large quantities in the mountainous regions of the Caucasus, but disputes having arisen as to the rightful ownership of the forests, the Russian Government has within the last few years prohibited its being cut; hence it has been sought for in these provinces. It is a wood that grows very slowly, and

requires much time to attain the size required for the market. It is thus probable that very few years will see the end for a time of this branch of trade in this part of Persia. Already, in Ghilan, it has become scarce; but vast forests of it are still to be found in Mazenderun. The governor of Ghilan, with a view to making the Persian Government profit by this rising industry, has thought fit to obtain the Shah's sanction to prohibit the further cutting of this wood without a special permission, and this measure has given rise to great dissatisfaction both amongst the owners of boxwood forests and those engaged in cutting and exporting this timber. The export of timber (walnut and boxwood) from the province of Ghilan during the year 1875 was valued at £20,000, the whole of which came to England.

The Californian Redwood.—To illustrate the size attained by this tree the *Sonoma Democrat* gives the following, which we quote:—"It is very difficult for the people in Europe to realize the immensity of our redwood trees, and we do not wonder at their incredulity. But their enormous size is a fact nevertheless. For instance, Murphy Brothers of this (Sonoma) county cut down and sawed into lumber at their mill a few years ago a tree that measured 375 feet in length and 10 feet in diameter, clear of bark. This tree made by actual measurement 37,000 feet of dressed lumber and 16,000 feet of rough, which sold at the mill at usual prices for 1,080 dols. Other trees in this county measure much larger in diameter, but very few make more lumber than this one."

Wood Fuel in India.—There are forty fuel reserves in the Madras presidency, the area of the whole being 5,748 acres. Since the beginning of operations these reserves cost 381,514 rs. and brought in 107,442 rs. In the year 1874-5, 848 acres of land were added to the plantations, the largest area being in the Cuddapah, Trichinopoly, and North Arcot districts. Some plantations in Malabar, Kurnool, and Bellary were given up in the year owing to the ill success which attended the endeavours of the department to get up good plantations. On the abandoned projects about fifteen thousand rupees were spent. It has been estimated that the fuel reserves now under the forest department will be capable of supplying 67,111 tons of firewood annually, against a demand made by the railway company of 128,680 tons.

Mauritius.—It is impossible to exaggerate the importance of arresting the denudation of our forests, and if we stood in need of any warning against so fatal a proceeding, we should find it in what has taken place in Mauritius within less than the lifetime of a single generation. Twenty years ago it was a *sanitarium* for invalids from India, to-day it is one of the unhealthiest islands in the world. To what cause is this remarkable change attributable? The question is answered in the *Farmer* by Mr. H. Rogers, Senior Assistant-Surgeon, Civil Hospital, Port Louis. He states that it is due almost exclusively to the denudation of the forest lands of the island, which has resulted in a diminished rainfall and increased temperature.—*Indian Agriculturist.*

Tree Planting in Algeria.—For some years past the Algerian colonists, encouraged by high prices and the success obtained by the great companies, have begun to make plantations of trees, amongst which *Eucalypti* predominate. To give still further encouragement, the Government has proposed that plantations should be made in every commune, and it will share the expense. From an inquiry lately held by the *Société de Climatologie* of Algeria, it has been found that wherever the *eucalyptus* has been planted to a large extent the intermittent fevers, so common in the marshy districts, have diminished in frequency and intensity.

A Royal Commission which was appointed in April, 1876, to inquire into the constitution, management, &c., of the Scottish Universities, has just issued a detailed and comprehensive report of its proceedings and investigations, in which it submits for the consideration of the Crown many liberal recommendations for the extension and improvement of the teaching at the four universities in Scotland, especially in reference to the Natural Science Chairs with which we are more immediately concerned. Excellent provision is made for the efficient teaching of the Science of Agriculture, Botany, Geology and Mineralogy, Chemistry, Natural History, Engineering, Natural Philosophy, &c.; a well-endowed professorial Chair, with one or more assistants as the case may require, being appointed for educating Students in each of them. We take the following extracts from the thirty-sixth article of the report, to show the provision recommended to be made for the teaching of some of these sciences; premising that proper provision is to be made whereby the emoluments of a professor will be not less than £600 a year, including fees paid by the students attending his class.

"The following provisions for assistance and apparatus shall be attached to different Chairs in the Universities of Edinburgh, Glasgow, and Aberdeen, viz.:—

(1) To the Chair of Natural Philosophy a first assistant with a salary of £250 a year, in addition to the present mechanical assistant at £100.

(2) To the Chair of Institutes of Medicine or Physiology two assistants, one at £150, and the other at £100 a year; also a sum of £1,000 for the purchase of apparatus and material of a permanent kind, with an annual sum of £100 for maintenance and provision of new material.

(3) To the Professorship of Botany two assistant demonstrators at £100 each, if the class numbers as many as a hundred; any additional demonstrators beyond two, if required by the size of the class, being provided by the Professor; and if the class does not much exceed fifty, one assistant demonstrator being sufficient. Further, that in Edinburgh the class-room accommodation at the Botanic Gardens be so extended as to be suitable for the increased number of students, and for the carrying on the laboratory work; and that in Glasgow the University buildings be extended so as to provide for the Herbarium and for laboratory accommodation.

(4) To the Professorship of Natural History (Zoology) two assistant demonstrators, at £100 each, on the same conditions, and subject to the same modifications, as specified in regard to the Chair of Botany, with reference to the size of the class; also £500 for a class museum, and £50 annually for its maintenance.

(5) To the Professorship of Geology and Mineralogy an assistant at a salary of £100; also £250 for a class museum, and £25 annually for its maintenance."

Equally good provision is to be made for the necessary equipment of the other Chairs of Natural Science, so as to fully meet the demands of modern education, and the wants of the various classes of the community.

With all this material ready to hand, it is to be regretted that the report makes no suggestion as to the institution of a School of Forestry in connection with the Natural Science Chairs. Indeed, we know of no good reason why Forestry should not have a Chair of its own, in one or all of the Universities.

As we have already pointed out in these columns, the University of Edinburgh possesses remarkable facilities for the creation of a School of Forestry, which, with some slight but necessary additions and proper arrangements, could be easily and economically converted into a thoroughly equipped Forest School, capable of teaching the Science of Forestry in the most complete and efficient manner. Such an institution is one of the greatest wants of the age in this country, and no country in the world requires it more. With India, Canada, Australia, New Zealand, and South Africa, not to mention numerous smaller dependencies of the British Empire, crying out to us to furnish them with thoroughly educated and practically qualified foresters, to conserve and restore their fast disappearing forests, or to create new ones, it is a standing blot on the institutions of our country that we cannot produce the men wanted, with every facility ready to thoroughly educate and qualify them, if only the will and the means were forthcoming to apply them.

Such an opportunity as the intended reforms in the Scottish Univer-

sities afford should not be allowed to pass by those interested in the establishment of a British School of Forestry. In all probability such a Science as "FORESTRY" was never thought of in the compilation of the report of the Universities Commission, and it behoves those interested, and the country generally, to see that the matter is properly brought under the notice of the Government before the suggestions of the Commission have passed into law.

What is the Scottish Arboricultural Society doing in this very important matter? Surely its voice ought to be heard in the most decided manner upon such a subject. Through the medium of its able and influential President and energetic Council, it should be in a position to take steps at any time to have such a vitally important matter laid before the Government in due form. In its efforts to do so we are certain that it would command the earnest support of all who are in any way interested in the rural prosperity of the country, as well as of those more intimately connected with the growth, sale, and manufacture of timber. The boon of having such an institution, in which to train our foresters, would be of inestimable value to India and our colonies, besides exercising a most beneficial influence on the management and productiveness of our home forests.

No institution of a national character has ever been established without meeting some opposition, let the cause be ever so vital, and the objections urged trivial in the extreme. Considerable stress has been laid by the opponents of a British School of Forestry upon the natural want of very extensive tracts of land under forests in this country, as rendering it unsuitable for the teaching of Forestry. No more untenable reason could easily be found. The same absurd objection applies more or less, and, we grant, with equally limited force, to all similar institutions nurtured within the area and upon the capabilities of this sea-girt isle. Is there any known civil Art or Science which cannot be taught efficiently within the limits of the United Kingdom? The very suggestion is simply preposterous. Because we have not the teeming multitudes of France, Germany, or Russia to experiment with, does any sane person doubt the capacity of Britain to teach the arts of statesmanship or war? by which the British Empire has been won and is ruled, to the admiration, and we may justly add the welfare of the civilized world? Then why, of all the arts, should we not be capable of teaching the Art of FORESTRY? and teaching it too in such a thorough manner as to enable our sons to go forth to the world armed with the knowledge and power to meet and conquer all foreign competition in the proper management of forests, natural or otherwise. With reasonable and unprejudiced people, any objections which have ever been raised against the establishment of an institution for the proper teaching of the Art and

Science of Forestry in the United Kingdom, will not bear a moment's investigation. The outlay at the most can be but an insignificant item in the national expenditure, and the immediate result would be a vast increase in Forestal economy and national prosperity.

In reference to students obtaining a practical knowledge of Forestry, while attending, for instance, a Forest School established in Edinburgh, nothing could be easier than to make arrangements with the Foresters on the estates possessing the most extensive and best managed forests in Scotland, or in England north of York, for practical instruction being given to any probable number of students, until such times as a special forest could be set apart by Government for the purpose. None of these forests are distant from Edinburgh more than a few hours' run by rail, and are easily accessible at all seasons of the year, which is more than can be said of the almost limitless areas of wild natural forests attached to most of the Continental Forest Schools. We have abundance of corroborative evidence that such an arrangement is the best method for teaching the Art and Science of Forestry. Our able and learned correspondent, Dr. J. C. Brown, of Haddington, has industriously collected from a variety of sources, and the best authorities, a large amount of valuable experience bearing on this subject, and which has appeared from time to time in our pages. An article from his pen in our present issue, to which we would draw the attention of our readers, is his latest and most conclusive evidence in support of the fact that it is not at all necessary, for the teaching of the science and technics of Forestry that a School of Forestry should be located in the midst, or even in the near neighbourhood, of a forest. So long as a moderate extent of well-managed forest is accessible to students, at any reasonable distance from the centre of education, it is found perfectly sufficient to meet all requirements in the teaching of practical forestry.

Special efforts have been made by Dr. Franklin B. Hough to collect every particular relative to the extent, value, and produce of the forests of the United States, so as to embody the statistics thus obtained in his report upon the Forestry of the States recently laid before Congress. We have been favoured with copies of the Circulars and Forms he has employed, which appear to be very suitable for the purpose, as the results obtained by their use clearly indicate, and they fully merit the notice of those who may be collating information and statistics on any kindred subject.

Forestry Circular, No. 1, is addressed to "Nurserymen and others engaged in raising and planting trees," with the design of obtaining facts of practical value with reference to the cultivation of trees.

They are requested to answer, by filling a blank form supplied for the purpose, from their own experience and observations, a series of questions on the indigenous trees commonly planted in their locality for ornamental or other purposes; the trees not native of the region which are found suitable to the soil and climate, and also those found not to be suitable, with the causes of success or failure; the diseases or injuries from insects, noticed in native or cultivated trees and shrubs, with the relative extent of such injuries, and any remedies found successful against them; the method of sowing, planting, and management found best adapted to the cultivation of particular kinds of trees; if forest trees have been sown or planted in the district, with what kinds of trees? and the area planted? Any facts observed in the neighbourhood indicating a change of climate by the clearing or planting of forests, and other meteorological incidents relating to rainfall, and the changes of the seasons; any facts noticed of particular kinds of trees in the native woods showing a tendency to die out, and the appearance of other kinds in their place, or where trees have not previously been growing; what are the chief kinds of timber-producing trees, the modes of transportation employed, and where the principal market is found; and finally, what manufactories are in the district using wood or bark as their principal material?

Forestry Circular, No. 2, contains a similar series of questions, addressed to Tanners and Manufacturers of Tanning Extract, with the view of obtaining facts of practical value concerning the supply and consumption of tanning materials; such as the quantities and different kinds of bark used, and their relative values as tanning materials; the prices of bark in former years; the average yield of bark per tree, and the usual yield per acre; if the timber of trees cut for bark is used, or left to decay on the ground; the average yield of tanning extract from a cord of bark; and various other items of information likely to be supplied from this source.

Forestry Circular, No. 3, requests information from the Superintendents of Railways, and those engaged in constructing Railways or supplying them with timber for construction, maintenance, or fuel, so as to lead to measures for economizing the use, and increasing the supplies of this essential material. Particulars to be given of the number of engines burning wood, the kind of wood commonly used, the average price per cord, the miles run with one cord of wood; the number of ties per miles, their dimensions and cost, delivered; the kind of timber they are made of, and its durability; the season of the year when ties are cut, and if it is observed to affect their durability, with the process used for preserving them against decay.

Forestry Circular, No. 4, is designed for the collection of statistics respecting Charcoal, and is addressed to the owners or managers of

furnaces, forges, and other establishments, having occasion to use it in large quantities, with the view of obtaining facts of practical value relative to its economical production and consumption. Answers are asked to questions anent the number of bushels of charcoal consumed per annum; number of bushels used in making a ton of iron; cost per bushel delivered; the different kinds of timber used in making charcoal and their relative value; the best mode of preparation; the liquid or gaseous products saved during the process of manufacture; and the average yield of good charcoal from an acre of woodland.

Forestry Circular, No. 5, is the last of the series, but by no means the least important one of them. It is addressed to Botanists, Entomologists, and other Observers in Natural History, and contains many important queries upon subjects which come within the range of students of Natural History, especially in its Botanical and Entomological departments; specially prepared blank forms being issued for filling up with replies for this section of the report.

In the report on the Canadian forests drawn up by the Hon. H. G. Joly, member of the Dominion Council of Agriculture, and which has lately been submitted to the Dominion Parliament, he points out very forcibly that the forest wealth of the Dominion is being rapidly exhausted. The splendid pine and spruce forests on the Pacific shores of the Dominion, in British Columbia, are scarcely yet touched by the omnivorous "lumberman," but from the confines of the Rocky Mountains eastward to the borders of the province of Ontario there does not appear to be more timber than is barely sufficient to meet local wants. The great forest of Canada, *par excellence*, is situated in the vast district watered by the Ottawa, the St. Maurice, the Saguenay, and their tributaries, and covers an area of over 100,000 square miles. There are also lesser, but still very extensive tracts of forest, in the Georgian Bay country; in the Muskoka and Nipissing regions; in eastern Quebec, and along both shores of the St. Lawrence to its mouth, and in the districts watered by most of the tributaries which flow into it; and also throughout the province of New Brunswick. These forests generally have been long worked, and at intervals have suffered terribly from fires, so that they cannot be expected to supply first quality pine for any lengthened period, but they still contain an immense quantity of spruce, sufficient if protected and properly worked to produce a full supply for many years. Spruce, unlike the pine in North America, freely reproduces itself, and a forest of it, if properly managed, will give a never-failing supply of excellent timber.

The great Canadian pine forest on the Ottawa, St. Maurice, and

Saguenay rivers, with their wonderful network of tributary streams, is rapidly disappearing beneath the ruthless axe of the lumberman. All the more accessible parts on these great forest outlets are already cleared of pine timber, and the lumbermen are now round the eastern end of Lake Nipissing, and away much farther north on the shores of the Montreal river. In the province of Quebec they have nearly reached the head waters of the Ottawa and the other rivers flowing towards the St. Lawrence, and are now working three hundred miles north of the City of Ottawa, on the shores of Lake Temiscamingue and the Keepawa river. The St. Maurice region is almost stripped of its finest pine. In the Saguenay region there is still a considerable amount of spruce, but it is completely gutted of pine. All the pine easily accessible from Lake St. John is cleared out. That huge tract of forest between the Ottawa and the St. Maurice, which once seemed endless and inexhaustible, has been pierced through and through, and is fast disappearing beneath the destroying axe.

The idea that the lumbermen "can still go north," when the present supply is exhausted, is a fallacious one. The lumberman is now plying his axe within a short distance of the head waters of the rivers flowing southwards, and as soon as he passes the heights which divide the watershed of the St. Lawrence from that of Hudson's Bay, the streams, without which the timber cannot be brought to market, all run north towards Hudson's Bay. There is undoubtedly some good timber in that region, but it may be considered out of reach for the present, as it is utterly impracticable under existing circumstances to bring it to market so as to realize a profit. In a comparatively short time the Canadian forests have been completely overrun and the finest pine picked out, seriously impoverishing them for generations to come. Although spruce and second-rate pine are still plentiful, and much in excess of any probable local wants, really fine pine fit for exportation is getting very scarce and inaccessible, and fears are entertained of a sudden and considerable falling off.

As far back as the year 1696 the attention of the French Governors of Canada was called to the wasteful destruction of the forests. However no check was put upon it then, and little has been done since. The result is painfully apparent, especially in the province of Quebec. A stranger may travel for miles in some parts of the province without meeting with a tree worth notice, and might easily fancy himself in one of the most tree-denuded countries of Europe.

Mr. Joly's report then enters fully into the subject of renovating the primeval forests, quoting examples of what has been done in European countries, and making many valuable suggestions upon the selection and planting of trees, from which we give some extracts on another page. If the Government of the Dominion carry out with energy and

spirit the suggestions and recommendations contained in the report, their forests may, in the course of a generation or so, regain some of their pristine luxuriance and vast richness in the production of the finest pine timber, which have been so wantonly sacrificed in past years.

JUDGING from the first three weeks of last month it appeared likely that we should be favoured with an unusually early spring, but at the time of writing winter has returned amongst us in full vigour, and severe frosts and snow-storms have been the rule in most parts of the country, from which it is to be feared that the rapid progress which vegetation was making will receive a severe check. The dry and mild weather of the early part of the month enabled all forestry operations to be carried on with despatch, and foresters should now be well prepared for the bark-stripping season, which may still be expected to commence earlier than the usual average of seasons. The sap is already showing signs of activity in many of our oak plantations and coppices, and as soon as the bark will "run," not a day should be lost in commencing operations, and continuing them with the utmost expedition till the falling is completed or the season ends.

It has been proved that early stripped bark contains a much larger per-centage of tannin than that stripped towards the end of the season. Therefore a strong effort should be made to secure as large a quantity of bark as it is possible to do, during the earliest part of the season, when it is so much more valuable. A forester who does so is likely to realize the top price in the market for his bark—a matter highly, creditable to himself, and most satisfactory to his employer. We hope to hear of an improvement in prices this season, but it is yet too soon to speculate much on this subject. However, by trying to improve the quality of home-grown bark, by early stripping and careful curing, foresters will be taking a sure method of increasing its value, and adding to the returns derived from the plantations under their care.

GIGANTIC SILVER FIR.

THE following are the dimensions of a gigantic specimen of the Silver Fir which is growing within 400 yards of Kinnaird Castle, Forfarshire, the seat of the Earl of Southesk. It is about 80 feet in height, and measures 22 feet 6 inches in circumference of stem at one foot from the ground; measuring 14 feet 11 inches in girth at 3 feet from the ground. At five feet from the base a large limb springs from the stem, measuring 9 feet 3 inches in girth at a foot from the point of junction. Excepting this large limb, the tree has a clear stem of about 18 feet in height to where it divides into several limbs, forming a large branching top. The spread of the branches averages about 56 feet in diameter, having an entire circumference of 176 feet, and forming a fine shapely head.

Kinnaird Castle. ROBERT COUPAR.

Cultural First Principles.

By G. S. BOULGER, F.L.S., F.G.S., late Professor of Natural History in the Agricultural College, Cirencester.

VIII.—Fruits.

(*Continued from page* 750.)

The involucre of a collection of flowers, or inflorescence, may either fall off, when it is termed *deciduous*, or remain whilst the fruit ripens, when it is termed *persistent*. As a collection of flowers on one stalk is called an inflorescence, a similar collection of fruits is termed an *infrutescence*. As in my last paper, I will consider *angiospermous* fruits apart from those of the conifers or "gymnosperms." Like the involucre, the perianth or floral envelopes may be either deciduous or persistent; but the stamens always shrivel up or fall off after discharging their pollen. It is the central whorl or collection of modified floral leaves, or carpels, which form the essential fruit-forming element of the flower. From them are formed the capsule of the poppy or the foxglove, the pod of the pea and bean group, and the "keys" of the maple, sycamore, and ash.

Let us examine more minutely the fruits of our forest trees.

That of the Lime is a globular, fleshy, nut-like body, made up of several carpels, but seldom containing more than two mature seeds. As it is *indehiscent*, *i. e.*, does not split open, it is technically inaccurate to call it a capsule; as the calyx is below the ovary, or *inferior*, *i. e.*, does not adhere to its sides as in the gooseberry, it may not be called a berry; as there are several united carpels it is not a drupe. It agrees most nearly with the fruits of the grape and the nightshades, and is technically called a *nuculanium*.

The "berry" of the Holly belongs strictly also to this group of fruits, but is often called a drupe. The little black points at the top of the fruit, like those in an orange, are the dried remains of the persistent stigma, and must not be confounded with those on the top of a gooseberry, currant, or apple, which are the remains of the persistent calyx, and mark an *inferior* fruit,—not in quality, but in morphological or structural classification.

The beautiful rose-coloured fruit of the Spindle-tree,—

> "That in our autumn woodlands looks a flower,"

as Tennyson says, is a true *capsule*, since it is *dehiscent*, *i. e.*, splits when ripe.

The fruit of the Buckthorn is intermediate between a berry and a nuculanium, since the calyx grows round it and almost encloses it but it is commonly and less strictly called a drupe.

The well-known dry, winged, superior fruits of maples, sycamores, ash, elm, and birch, are known as *samaras.* The wings are produced from the ovary, one flower in the maples commonly producing two samaras, one for each carpel. These winged fruits must be carefully distinguished from those of the hornbeam, which have a wing-like adherent bract and form the winged seeds of conifers; for though the function of the wing-like organ is the same in each case, viz., to scatter the seed away from the parent tree, and in some cases, by its spiral curvature and sensibility to moisture (hygroscopicity), to bury the seed in the soil, the function of an organ whether in plant or animal is the most misleading of all guides to its structural nature, its developmental history.

The pods or *legumes* of peas, beans, vetches, furze, laburnum, and all the great group *Leguminosæ,* need only be mentioned as formed from one carpel, and dehiscing down both its front and back margins, the *dorsal* and *ventral sutures* of botanists.

The great tribe *Rosaceæ* has very various fruits. Those of the plums, cherries, and cherry laurels, as of almonds and peaches, are what are commonly called "stone-fruits," *i. e.,* true *drupes, superior,* formed from one carpel, and having the outer part of the fruit, or *epicarp,* fleshy, whilst the inner, or *endocarp,* is stony. For the "stone" must not be thought to be the seed: it is equivalent to the "core" of an apple,—the seed, the equivalent of the "pip," being the "kernel." The fruit of the blackberry and raspberry is a collection of small drupes or *drupels,* and are to be distinguished from the infrutescence of the mulberry, in which, as in the pine-apple, the fruits of a whole cluster of flowers or inflorescence are united together into one "false fruit" by succulent floral envelopes. Such an infrutescence is termed a *sorosis.* The carpels of the strawberry are the little dry "pips" on the surface of the fleshy *receptacle,* which corresponds to the central knob on which the similar dry carpels or *achenes* of a buttercup are placed, or that in the centre of a raspberry. The fruit of the rose, or "hip," is the same thing turned outside in, the hairy achenes being enclosed in the scarlet receptacle. This is consequently an inferior fruit, as also are those of the apple, pear, service, mountain ash, and hawthorn, in which we have a bony or parchment-like endocarp, surrounded by a fleshy epicarp, usually of five confluent carpels, crowned by the calyx. This is termed a *pome.*

The so-called seed of caraway, carrot, and other *Umbelliferæ,* is one carpel or *mericarp* (half-fruit) of a dry, inferior fruit of two carpels, called a *cremocarp.* The fruits of the ivy, the dogwood, the guelder

rose, and elder, being inferior, are true berries; whilst the small florets which make up the inflorescence of daisies, dandelions, thistles, coltsfoot, and all the great family *Compositæ*, are each succeeded by a small fruit, also inferior, crowned with the well-known "down," or *pappus*, which serves it in lieu of wings. This fruit is called a "cypsela," and contains one seed, being, in fact, an inferior achene.

Each female flower in the catkin of a willow or poplar is succeeded by a capsule containing seeds, with tufts of hair to perform the function of dispersal.

The *glans* or nut of the beech, the hazel, the hornbeam, the Spanish chestnut, and the oak, is an indehiscent fruit with a dry or horny *pericarp* or exterior, a superior calyx, and persistent bracts or cupule. It is important to distinguish between the fruits of the Spanish chestnut and their spiny investment of abortive branchlets, and the brown seeds of the horse-chestnut with the spiny pericarp of the capsule that encloses them. The fruit of the walnut, which, when unripe, is pickled whole, is inferior, and having a fleshy epicarp and bony endocarp (the "shell"), is comparable to the pome, from which it differs in being dehiscent. The planes have a superior nut-like fruit, crowned with a persistent style, and surrounded with a whorl of stiff hairs at its base; whilst that of the alder, similarly forming one of a persistent catkin, globular in the plane, cone-like in the alder, is also similar in structure, being dry, superior, and indehiscent,—in short, a wingless samara.

After mentioning that the fruit of the box is a capsule, we have only to describe our coniferous types. As these plants have no true ovary or closed carpellary leaves, their so-called fructification consists of a collection of naked seeds, not of fruits. The scales which form the cone, whether branches or carpels, are woody in pines, generally with two winged seeds at the base of their inner surface, and in *arbor-vitæ* and juniper are few in number, less cone-like in arrangement, fleshy, and almost enclosing the unwinged seed.

These few notes of structure and terminology are designed only as a guide in the practical study of fruits which is essential to a thorough knowledge of woodcraft.

(*To be continued.*)

Bark and Bark-stripping.

By ALFRED J. BURROWS, Pluckley, Kent.

The operation of stripping and properly harvesting bark in a cold wet season is one calculated to tax to the uttermost the patience, skill, and energy of the forester. During the ascent of the sap there is a period at which, if an oak be felled, easy and expeditious stripping is the result; while, if it be delayed beyond that time, the work becomes more difficult, and the quality of the bark also deteriorates.

The bark of exogens consists generally of three parts,—the outer skin, or *cuticle;* the solid part, called also the *cortical integument;* and the inner bark, or *liber*. In most trees the outer skin is so unyielding that it cracks and sometimes peels off. The liber is generally very thin; and every year a concentric zone of it is formed inside that of the preceding year. Though the bulk of it appears to be a mass of spongy fibrous matter, the inner layer is easily separated from the others. At an early period in history the liber was stripped off in layers, and formed into leaves for writing upon: hence its name.

Besides acting as a protection to the delicate structure of the young plant, the bark serves to convey the descending fluid or elaborated sap back to the roots, after a portion of it has passed inwards through the medullary processes.

In the present paper we purpose to confine our attention to the use of bark in tanning leather, and to give a brief account of the method adopted in stripping and harvesting.

The art of preparing leather by using substances possessing astringent properties is said by Pliny to have been practised by Tychius of Bœotia. But though the practice continued, but little inquiry was made into its principles till about the middle of the last century, when a temporary scarcity of bark for tanning purposes directed attention to the subject. This resulted in the discovery that many other vegetable substances contained *tannin*. The Germans were using birch bark, gall-nuts, and pulverized heath; the Russians, willow bark; the West Indians, the bark of the red mangrove tree; the Italians, leaves of the myrtle; and the Corsicans, laurel leaves.

In France, M. Seguin made many important discoveries in relation to the process of tanning, which were published in 1756. Sir Humphrey Davy ascertained that all substances possessed of an astringent taste contained tannin. He found it abundant in the juices

of sloes , and his friend Mr. Poole, of Stowey, made the more palatable discovery that it exists in port wine.

Hides stripped of the hair and outer skin consist wholly of gelatine, which is easily soluble in water, and which forms when combined with water the jelly called glue. The tannin of bark, which is an antiseptic, is also readily soluble in water, and then combines with the gelatine of the hide, and the two together produce a substance highly imputrescent. The fixed acids, querci-tannic and gallic, have the power of preventing decay in animal and vegetable fibre, and are abundant in oak bark.

While the tannin principle of the bark, by contracting the pores, enables the leather to resist the action of air and water, and to withstand putrescent tendencies, softness and durability in the leather produced are to a great extent due to the presence of another substance found in bark, and called by the chemists *extractive.* This substance resides mainly in the brown or middle part of the bark ; while the white cortical layers next the alburnum, or sapwood, and which are generally most abundant in young trees, contain the largest amount of tannin. The epidermis, or skin, supplies neither.

Leather prepared by most of the chemical substances now so freely used, or by an infusion of galls, cracks ; and that prepared with birch bark is more or less fragrant.

It has been ascertained that the bark of trees under twenty years old has not arrived at perfection ; while after thirty years it becomes more corky, and diminishes in the yield of both tannin and extractive. Spring-stripped bark, also, contains more than four times the quantity of tannin which can be found in the same weight of bark cut from the trees in winter. The astringent property varies according to the age of the trees, being most abundant in those of middle age and vigour.

When the cost of labour was much lower than at present, and bark realized a higher price in the market, a considerable quantity of oak coppice was cultivated principally for its bark, and rotations of twenty-four or twenty-six years were found most remunerative. The stools were generally most productive at distances of about 8 feet apart ; and the shoots were thinned out at the end of the second year and subsequently pruned. The great reduction in price consequent upon the large importations of foreign bark, and the free use of chemicals, have materially lessened such cultivation.

Monteath maintained that the bark from a natural stool of oak wood, at the age of twenty-four years, equalled in weight that from an oak tree fifty years old, while the quality of the former was greatly superior.

At one time, any kind of bark containing a considerable per-centage of tannin was marketable, including the Spanish chestnut, willow, and mountain ash, and later still the birch and larch. But the large

supply from America and the Netherlands, and other causes mentioned above, have restricted the demand in this part of the country to oak bark alone.

From the years 1825 to 1827 the average prices of the various kinds of bark in use in London ranged as follows:—oak bark, £14 15s. per ton; sweet chestnut, £11 11s.; birch, £7 7s.; and larch, £7.

Birch bark will generally peel nearly a month before the oak; though, as the different layers required to be separated for the use of the tanner, the operation was often deferred till June or July. When larch was stripped, only the body bark was used.

With most oak trees, the period when the bud is just bursting into leaf will be found the proper time for falling, to insure easy stripping. By deferring the work much beyond this time there is a perceptible loss in weight and a considerable deterioration in quality. The difference in weight is so great as sometimes to amount to ten per cent. loss when the leaf is fully out.

In order to secure the possibility of a good stripping season, the forester requires to make early arrangements for marking and numbering trees, and estimating the probable yield of timber. This will enable him to form an approximate idea of the quantity of bark to be harvested and the number of hands required.

It is but seldom that more than about twenty-eight days are available for the operation in any one district. In the south and east of England the period ranges from the 20th of April to the same date in May, or from about the 1st of May to near the end, according as the season is an early or a late one. Farther north it will extend from the middle of May to the end of June, or even later, according to latitudes and exposure.

Healthy trees generally break out earliest into leaf, strip easily, and yield good bark: unhealthy ones come out late, and often hang in the bud, peel with difficulty, sometimes requiring hammering, and produce inferior bark.

The weight of bark produced by a given number of loads, tons, or cubic feet of timber, will depend very much upon situation and aspect, as well as upon the age of the trees and the time of stripping. The heaviest bark will generally be obtained from trees which have grown in sheltered hollows having a southern aspect; and the faster the growth of the tree, and the more sapwood it contains, the better the bark, especially if the tree has remained in a healthy state up to the time of felling.

A flourishing tree with a good head and well proportioned will often produce from five to six cwt. of bark for every ton of measurable timber it contains, especially if peeled down to branches of one inch in

diameter, which should always be done, as the bark of the smaller branches contains in proportion to weight more tanning matter than that of the stem. In ordinary cases, where the trees are of medium age, and average about 10 feet each, it will be safe to estimate a ton of well-dried bark for every 150 feet of measurable timber. Hedgerow trees have, under favourable circumstances, been known to yield as much as a ton of bark to three tons of timber. Plantation timber must be estimated according to the spaces afforded: where grown thickly the bark will be thin and light, while where sufficient space is afforded the yield may be estimated at one ton of bark for every four or four and a half tons of timber. Oak poles averaging one cubic foot each will not produce more than a ton of bark for every five tons of timber.

Having ascertained pretty nearly the total quantity of bark to be stripped during the season, the forester's next care will be to arrange for a sufficient number of hands to ensure its completion within the available time. The strength of the party must depend considerably upon the sizes of the timber, and also upon the circumstance of its lying well together or being widely scattered. As a general rule, the larger the timber the fewer the number of hands required; on the other hand, when small coppice shoots have to be felled, carried out, stripped, and the bark collected for stacking, a strong party will be necessary.

Where women and boys are employed in the operation, there must be special provision made for them in the way of pruning branches and carrying them out for stripping. Here, where men and strong lads only are engaged, and where the timber is generally of medium size, we find that six or seven men, with two or three strong boys, will cut down, strip, and stack a ton of bark per day in a favourable season. Last year one party of ten men turned out twenty-three tons of bark in nineteen days, and the season was a very unfavourable one, many of the plantations having to be gone through a third time before all the trees would run.

As the regularity of procedure throughout the season will depend so much upon previous arrangements, the forester should finish marking before the stripping season commences; and it may be well to remark here that all thinnings should be gradual, as too sudden an exposure frequently checks, if it does not altogether stop, the growth of trees. As a rule, sister oaks upon the same stool should never be separated, nor hedgerow trees which have grown close together. For exposed situations the system of group falling is strongly recommended, so that each quarter may retain its natural boundary where the branches hang low and exclude the cold and destructive winds.

During the stripping season the flow of the sap will be very much

influenced by the situation and exposure of the trees, as well as by the character of the soil and the weather. Sometimes the upper branches of a tree will strip freely while the trunk bark remains bound; at other times the tops exposed to frosts or cold easterly winds remain almost immovable, while the more sheltered trunks peel freely. All this should be ascertained before felling a tree, as it should be stripped within twenty-four hours of the time of cutting down. Even one side of a tree will sometimes strip, while the other side resists the peeling iron. An experienced eye will generally tell the fitness of a tree at a glance. All hammering of the bark should be avoided, as this operation drives out the tannin, and thereby reduces the value as well as the weight, produces a black colour inside, and causes rapid decay in a bad season.

Elaborate directions as to the arrangement of gangs and the exact form and shape of tools are unnecessary. Every district has its peculiarities in these respects. Tools must be adapted to the strength and skill of those who use them, as it is not every David who can wield the sword of a Goliath. The necessary ones are heavy axes for falling, lighter ones for severing branches, billhooks for smaller branches, and for cutting round the lengths of bark upon the trunk, peeling irons for stripping, and wooden malls for beating refractory bark, and for loosening that upon the smaller branches. These form the chief stock-in-trade of the "flawers," as bark strippers are called in Kent. The wooden mall should be of ash, about four inches square at the head, seven inches long, with an edge available for opening the bark for removal. The stripping chisel is generally about two and a half by two inches, the entire handle being a foot long.

Up to six or eight inches in diameter trees are generally felled with the axe; above that size it is economy both of time and timber to use the cross-cut saw. Before inserting the saw a few feet of the body bark should be removed, as much for the greater convenience of stripping as to prevent its being damaged. The larger trees being peeled where they fall, the smaller ones are frequently carried out near the stacking ground, and stripped while one end rests upon a horse formed of two stout sticks driven obliquely into the ground, and crossing near the top.

The trunk or body bark is generally removed in lengths of thirty or thirty-six inches, and laid aside for subsequent use in covering up the stack. As soon as stripped the bark should be at once carried to the stacking ground, and carefully arranged upon the stages. Any exposure to the sun of the inner surface not only injures the colour of the bark, but also greatly lessens its astringent properties. Well-harvested bark should finish up with a bright creamy colour; a dull brownish hue indicates little tannin property, or injury from exposure to sun, rain, &c.

Where boys are employed in stripping close supervision will be necessary, or the smaller branches will be thrown aside. We have observed throughout a large fall sufficient bark thus left behind to have paid the entire cost of the stripping.

The places selected for drying should be open and airy, and as near clearance roads as possible. In a favourable season bark may be expeditiously dried by being arranged with one end upon the ground and the other resting against a rod, which in its turn is supported by forked sticks driven into the ground. But as a precaution against injury from wet it is better stacked upon a raised stage formed of forked sticks about two and a half feet long, driven firmly into the ground, while stout rods are placed transversely and smaller sticks longitudinally upon these, so as to form a tolerably close platform, upon which the smaller pieces of bark are built up loosely, and finally thatched or covered in with the bark from the trunk, so as to throw off all rain, and at the same time admit a free current of air around and beneath the stack.

With an average season and careful stacking no turning will be necessary, but should unfavourable weather cause it to remain longer than twelve or fourteen days in the stack, it will be desirable to choose a fine day, and open and rearrange the bark to prevent mouldiness. Its fitness for delivery may be tested by its brittleness, and by its breaking rather than bend under pressure.

In districts where the bark season is generally a hazardous one drying sheds of some kind should be prepared. A light wooden framework capable of being quickly set up, or taken down, to carry sheets of corrugated galvanized iron, will be about the cheapest form we can suggest. The corrugations give rigidity to the iron, so that very little support is needed. At the present time we have a considerable quantity in use for various purposes, which was bought, soiled, for £15 per ton, delivered, Birmingham gauge No. 24, weighing about one pound per square foot, and costing, therefore, somewhat less than 1¾d. per foot.

As in this district the bark is delivered entire as taken from the trees, it is generally tied up in bundles of convenient size for loading and unloading, with withes, at a cost of from 1s. 6d. to 2s. per ton. The delivery on rail averages about 3s. per ton to the nearest station. It was formerly chopped into small pieces at a cost of 6s. or 7s. per ton, and delivered in bags. It may be observed that well-dried bark loses about one-third of its weight in harvesting.

The cost of stripping, &c., should be proportioned to the sizes of the timber. Taking the season through, we have paid 32s. per ton of 20 cwt.

As soon as the "flawing" is finished the oak tops are cut up and

tied into substantial household fagots, worth from 25s. to 30s. per 100, at a cost of 4s. 6d. The larger branches are cut into cordwood, each cord measuring 14 feet long by 3 feet high, and 3½ feet wide, and containing 147 cubic feet. This sells at from 25s. to 33s. per cord, delivered. The price for cutting and stacking is 3s. per cord.

From among the larger branches are selected spars for gate-posts, cut out at 2d. each, and good gate and fencing posts of large sizes at 6d. each. A quantity of the small brushwood, or "scramble," is tied up by the men for their own use. They are also allowed all dead wood and chips.

TREE PLANTING IN WASHINGTON.

In the *American Agriculturist* Mr. Peter Henderson pays a merited tribute to the skill, taste, and judgment of Messrs. William Saunders, of the Experimental Garden of the Department of Agriculture, William R. Smith of the Botanic Gardens, and John Saul, the nurseryman and florist, who compose the "Parking Commission," and whose work in planting the fine avenues and streets of the City of Washington with handsome and appropriate trees has produced, as he says, results that probably no other city can equal.

Already 40,000 trees have been planted, some thirty kinds being used, the bulk, however, being of ten kinds. These, named in the order they are valued by the commission, are the following:—Silver or White Maple (*Acer dasycarpum*), then American Linden (*Tilia Americana*), American Elm (*Ulmus Americana*), Scarlet Maple (*Acer rubrum*), Box Elder (*Negundo aceroides*), Sugar Maple (*Acer saccharinum*), American White Ash (*Fraxinus Americana*), English Sycamore (*Acer pseudo-platanus*), English Button Ball (*Platanus occidentalis*), Tulip Tree (*Liriodendron tulipifera*), Honey Locust (*Gleditschia triacanthos*), and Norway Maple (*Acer platanoides*).

These and the other sorts are set 20 to 25 feet apart, and there are miles and miles of streets in which not one dead or diseased tree can be seen, which shows the planting must have been done in the best possible manner. The trees were transplanted as the first necessity, and the commissioners frequently receiving from distant parts trees which were not in a satisfactory condition as to their roots, planted them out in their own grounds one season before risking them in the streets.

The trees when planted averaged an inch and a half in diameter, and twelve feet in height. The hole for the roots is dug about five feet across and two feet deep. When the natural soil is unsuitable, good soil is brought from elsewhere. Every tree when planted is surrounded by a plain but substantial sparred tree-guard six feet high, which serves the double purpose of protecting the tree from injury by cattle, &c., and of *shading the stem from the sun*,—an important precaution, since trees grown in masses, either in nursery or forest, shade each other and suffer greatly when removed and exposed singly to the blazing sun. The great success in planting the avenues at Washington is no doubt due to the persistent use of this precaution, which is never omitted.

When this work, which has been going on for five years, is complete, one may then drive for 200 miles through the broad and ample shaded avenues of the American capital, and imagine they are passing along the rides of a great park.

Technics of Forestry.

No. IV.

By J. CHARLES KING.

(*Continued from page* 624.)

The extent of knowledge is not in what we know, but in how we know things. The power of knowledge is in its application. The true use of knowledge is to make it subserve human welfare. Judged by this simple standard, how limited, feeble, and inaccurate are the teachings of almost everything that pertains to forestry in the daily and general press! One of the popular delusions inculcated is that the wood of the poplar will not burn; another, that oak backing to armour-plates increases the resistance of the plate to the penetration of shot and shell. The *Journal of Forestry*, by the diffusion of correct information, will do much to eradicate this misteaching.

Nor do the writers for the general press stand alone. The highest departments of Government display conspicuous examples of ignorance; even in the Arts and Science Department at South Kensington Museum, where we have a right to expect a better and more correct state of things, there is amongst the specimens of forest tools used by the Malays and Chinese a very heavy thick-backed woodward's bill; this is labelled a sickle, and as if to prove that the ignorance was not accidental, a "draw-shave" for bellying-out tub-staves is also labelled a sickle. Even their class-books are not free from the taint. One is entitled "Dynamics Theoretical Mechanics," as if dynamics were not practical mechanics, and but a part of mechanics either. I glance, in passing, at these things, and wonder, with the poor ill-taught woodward, where correct teaching is to come from, if these pretentious teachers are at fault in their A B C of technics and science.

To those writers who have differed from me I am indebted for making me the gainer by their working experience. I am glad to find that our views and experience differ. If I stated only that which was known to them it would render my aim futile. I am sure your readers as well as myself are pleased to note the earnest and explicit statements of the writers on forest tools. I may explain, that while admitting that suitable saws are made for felling large trees, old pit-saws are generally used from their being within the means of the woodwards to purchase; and also, as far as I have seen, they are preferred to the cross-cut saw, which is better suited for cross-cutting logs or timber when fallen, being shorter and handier than the longer pit-saw.

The following is a list of tools and prices furnished me by one of the most expert and experienced woodwards in Hertfordshire :—

	s.	d.		s.	d.
Light bill	2	6	Beetle with iron rings on	2	6
Heavy ,, ...	2	6	Short cross-cut saw ...	9	0
Light axe	6	0	Long saw, second-hand, bought of pit sawyer	10	6
Heavy ,, ...	7	6	Mittens	3	6
Mattock	3	6	Gloves	2	6
Bramble hook	1	8	Sharpening stones ...		
Three wedges, the largest notched to keep it from flying back	6	0	Rod-pole		

PRICES FOR FALLING AND TYING.

The woods are generally well known to the elder woodwards, who may have done each previous cutting ten years before: this being the term of interval in this and adjacent counties. The head woodward begins a wood so that the run of the work shall be parallel with a ride, or the side of the wood. The "view," as it is called, is opened 2½ rods wide, and every 8 rods long is marked by leaving a few sticks uncut. This clearing is called a "ringe," or "range," for which 8s. 6d. is paid. In this "ringe" is taken down timber, if any, and the "firsts," "seconds," and "thirds," as the tree growth of each ten years is termed. The "firsts" are used for whipple-trees and way-trees; "seconds" for cart standards; "thirds" for felloes, if of ash. The uses to which other woods are applied will be explained further on.

The poles, if made into hurdles, at 5s. 6d. per dozen, sell at 14s. per dozen. Brushwood is made into fagots. To cut, trim, and tie 40 fagots and 40 round wood takes three men three hours nearly.

The hazel are made into bundles and sold for thatching rods.

The charge for chopping down trees is 6d. each: all trees more than 6 inches square are sawn down. Large trees cost 2s. 6d. to saw down, and if 2 feet 6 inches square will take five men about one hour to saw down. If 15 inches thick three men are nearly half an hour sawing it down. This time includes clearing away and levelling ground for the saw.

The following is an account of a 10 acre fall :—

	£	s.	d.
Underwood fagots, 11,234, 2d. each .	10	5	8
Poles made into hurdles . . .	65	8	0
300 thatching rods, at 7d. bundle .	8	2	6
175 pea sticks, at 4d. ,, .	2	18	4
Withs, 16,000, 1s. per hundred . . .	8	0	0

Falling and tying up cost £30, able-bodied men earning 18s. per week.

Tools and clothes cost each man about 2s. per week.

The oaks, 89 in number, were taken down for the same as ash. Bark-peeling, £1 per ton, yielded 11 tons of bark at £4 4s. per ton; the trees averaged 11 inches square. The timber valued at 2s. 6d. per foot, 1,500 top-wood fagots, 1,500 round wood at 3s. per score when sold, sells for 3s. 4d. per score.

The charge is 5d. a score fagots, and 5d. a score round wood.

An oak which will realize £9 round measure will yield 33s. worth of bark, and the fagots and topwood will sell for 25s. The cost will be for five men to saw it down, peel, trim, and tie up, 17s. 6d.

For trimming, or planting, loading, carting, and unloading, able-bodied men get 2s. 6d. per day.

To get out fo the wood 1,500 fagots or topwood requires four horses, one driver, one pitcher, one loader, one unloader, and two stackers.

In my previous remarks I alluded to the distinction between the honesty of policy and the honesty of principle. The difference is obvious in the matter of trees being sawn down and chopped down.

(*To be continued.*)

Arbutus Unedo.—Judging from comments which have appeared in recent issues of the *Gardener's Chronicle*, this shrub is considered by many as only fit for very sheltered positions, in consequence of which it is not as extensively planted as it otherwise might be. The branch which I forward for your inspection has been cut from a huge bush growing here in the shrubbery in company with a host of other things common to such places, and is planted without any apparent regard to shelter being afforded it by its companions. As we are situated only six miles south of Manchester, I think this is argument sufficiently strong in favour of its hardiness, while as to effectiveness it is always so, no matter whether divested of floral attractions or enhanced by them, but doubly so when, as now, it is covered with its crimson fruit.—J. Brierley, *The Towers, Didsbury.*

Swine as Destroyers of Field Vermin.—A Posen farmer, writing to the "Landwirth," insists upon the great value of swine as exterminators of field mice and other vermin. He believes that the terrible plagues of mice now so prevalent in many parts of Germany are in great measure due to the present system of keeping swine penned up, instead of allowing them the range of the fields, as was formerly the custom. He states that a careful observer may often detect pigs in the act of snapping up and devouring a good-sized mouse, besides which they have an extraordinary keen scent for the nests, grubbing them up most artistically in search of the young mice, which they eagerly devour *in situ*. The fields that have been cropped with lupines or oats, the swine, when turned in, invariably select the spots where the ricks have stood to grub in, not, as might be thought, in search of stray grain that may lie there, but because these particular places are swarming with mice nests.

Forestry in the State of Nebraska.

By J. T. ALLAN, Omaha, Neb., U.S.A., Statician to The American Forestry Association.

The *Journal of Forestry* is a very welcome visitor even at this distant spot, and as forestry progresses to a higher standpoint its teachings will be highly appreciated on the great plains which stretch 800 miles eastward from the Rocky Mountains. At present the great work which the American Forestry Association is striving to accomplish is to awaken the people to the danger of a timber famine, to show the vast annual decrease of forests, and the great necessity of planting to a large extent. To do the latter in the most effectual manner we must look abroad for the knowledge and experience of our elders.

Hence the commission which we ask for to visit Europe, and trust that the present Congress will furnish the necessary means. Accept our thanks for your pleasant notice and token of good-will for the enterprise. Our earnest working friend, Dr. Warder, goes to Washington this month to aid the cause. I send you a few notes showing what is being done in this new State by unskilled hands.

The State Horticultural Society to encourage forest tree planting awarded the following premiums last month :—

For the greatest number of forest trees planted in 1877 by one person, $50 ; the highest number being 95,900 trees, and planted in a county which in 1870 had but fifty-four inhabitants.

For the greatest number planted on the second Wednesday of April, 1877 (Arbor day), being 23,300 trees, $25.

For the greatest number planted during the month of April, 1877, being 72,600 trees, $25.

The reports received show a vast increase during the past year. One county reports having planted three and one-half millions of trees.

Another, settled six years ago, reports 800,000, besides 500,000 cottonwoods.

Another farmer reports, "I planted the first grove in this county (150 miles in the interior) in 1860, being 3,000 trees of ash, walnut, and cottonwood, the latter now being seventy to eighty feet high.

"Since 1870, as these have been thinned out, the spaces were filled with seeds and nuts of the white and black walnut, ash, elm, &c., and now there is a promising growth of trees more valuable than the poplar, which have fulfilled their mission as pioneers."

The above illustrates the homely but practical manner of planting adopted by our new settlers. This poplar (*Populus monilifera*) is of great value at the start, furnishing as it does fuel and shelter (the latter of great importance) in a short time.

The writer has seen a growth of eight feet with a diameter of an inch at the ground produced in a single year from a cutting ten inches long. The article published in your January number, from Dr. Warder, truthfully represents the poplars as seen by American eyes, but it is liable to bring out discussion, and in the end lead, as you say, to a correct knowledge of the varieties of quick-growing species of the utmost importance to the forester.

By a recent Act of Congress, passed to encourage the growth of timber on the western plains, any person entitled to take a homestead is also entitled to 160 acres, 80 acres, 40 acres, or a fractional subdivision of less than 40 acres, on condition of planting one-fourth of the tract with timber, and keeping the same in a thrifty growing condition for a period of eight years. Residence upon a timber claim is not required, and it is also exempt from taxation, and from liability for debt, until the issuing of the patent.

So, by this, a man can have a tract as above in fee simple (save about $20 dollars for 160 acres, the charges at the land office) for planting timber trees, and Nebraska claims credit for the Act, as the bill was presented to Congress by Hon. P. W. Hitchcock, senator from this State.

I extract the following from the report of the late meeting of our Horticultural Society last month, that you may see we are awake to these important interests on our treeless western plains.

Forest growing has perhaps been as prominent a subject as any discussed at this meeting. The next report of the society will show that several counties have planted millions of trees.

Mr. C. H. Walker offered the following resolution in reference to the timber interest, which was unanimously adopted :—

"Resolved—That our senators and representatives in Congress be requested to use their utmost endeavour to secure an amendment to the Timber Culture Act, to provide for the withdrawal of one quarter of every section of the public lands, now subject to entries under said Act, for the purpose of timber culture."

Mr. Walker also offered the following, which was unanimously adopted :—

"Resolved—That our senators and representatives in Congress be requested to urge an amendment to the Homestead Act, requiring the cultivation of at least four acres of timber on homesteads located on prairie lands before a final receipt shall be given."

No State has shown a more rapid growth than Nebraska since its

admission into the Union. Already it has the appearance of an old settled country. Well-cultivated farms, school-houses, and villages meet the eye in every direction. The interest taken in tree-planting is covering the once treeless hill-sides and prairies with thrifty artificial groves, and the time is not far distant when it will become widely noted for the picturesque beauty of its scenery. The population in 1860 was 28,651; in 1870, 122,993; showing an increase of 330 per cent. during a period of ten years. Reliable statistics clearly prove that the greater portion of this increase accrued during the last three years of the decade. The number of registered voters at the last general election indicates a population of 300,000 people.

Full statistics will be received about May 1st, which it is believed will show a planting in the State during 1877 of not less than twenty-five million of trees, exclusive of fruit.

My introduction to the *Journal of Forestry* was through a valued correspondent, Dr. J. Croumbie Brown, of whose valuable work on Forests and Moisture I am the fortunate possessor. I trust ere long his works will be widely read on this side of the Atlantic Ocean.

A FOREST COURT.

Apropos of the interesting paper on Forest Officers in the fourth number of the *Journal of Forestry*, the following note on the "Speech House" in the Forest of Dean may be worthy of remark. This "Speech House" stands in the middle of the forest, and was erected in 1680. Here was held the "Court of the Speech," or that of the miners and verderers. It was thus an exceptional court, comparable to that of the Stannary and also to ordinary forest courts. The Woodmote and Swainmote may have been held here, but the following seems to refer to the presentments to the justice-seat or chief justice in eyre. The forester on entering the court knelt and delivered his horn to the chief justice. The miner similarly delivered up his insignia—the hatchet. The "hands," or witnesses, were sworn standing, each holding a piece of holly. In connection with this last custom it is remarkable that though oak and beech are now the principal timber trees in the forest, there are some very fine hollies, some six feet in girth, near the Speech House, standing on what a highly probable tradition looks on as the oldest part of the forest.—G. S. Boulger.

Opinions of Continental Foresters, and Professors of Forest Science, on the Location of a School of Forestry.

By THE REV. JOHN C. BROWN, LL.D., Haddington.

(*Continued from page* 761.)

In continuation of his speech, Dr. Von Seckendorff said that he attributed the establishment of isolated special schools of forestry to the state of the forests in a bygone day, and to the limited education required for the forest service of that day, which was not such as would fit the applicant for a university course of study. But things were now completely changed. A more exact and scientific method of research in forest matters had been introduced, and there was demanded of students of forest science a higher testing examination; and the exact point at which forest academies ceased to be sufficient, and should give place to more comprehensive *Hochschulen*, could be pointed out. It was from the moment that there were required of candidates for appointments in the Forest Service the very same educational attainments as were required of candidates for employment in other departments of the service of the State. The advocates for special and separate forest schools were accustomed to attribute to them a number of advantages over the *Allgemeine Hochschulen*. But when all questionable or adventitious advantages were subtracted there remained only these two:—1. In these isolated institutions the students were trained in practical forestry; and 2. Only in these were the necessary studies conducted with a special reference to the requirements of the forester. But underlying these, again, there were two assumptions:—1. That in the vicinity of the *Allgemeine Hochschulen* there were no forests suitable for being used in the instruction of students. 2. That there in the very nature of the thing a purely theoretical education must prevail. And he alleged that as a matter of fact both of these assumptions are found to be without foundation. The number of towns in Germany, richly surrounded by woods, which were the sites of *Hochschulen* and of universities, was very great. In a line drawn from the coast of the German Ocean to the place of meeting where they were assembled alone there were Hanover, Göttingen, Marburg, Giessen, Heidelberg, Carlsruhe, Freiburg, all so surrounded; and, moreover, the extent of a forest was not the property of it on which depended solely or even

chiefly its suitability for employment as a means of instruction—but the variety of kinds of trees, of modes of treatment, of exploitation, and of technical applications of the products. And that was the most suitable in which the greatest number of these could be most easily obtained. Looked at thus, a very great advantage of many of the forest academies was possessed by many of the universities. And further, in the selection of localities for forest academies it was not a regard to the vicinity of the forest which was always the primary determining motive. Economical considerations had, in many cases, decided the location; and when it was not so, then it was often the case that a consideration of the interests of the town had a greater weight than had the peculiarities of the forest.

And the second assumption, said he, will not bear examination. Science and practical work are not antagonistic to each other. And of the *Hochschulen*, do not all offer the same facilities for practical demonstrations as do the forest academies? Their facilities for forest excursions must not be left out of view. Further, there is no certainty whatever that the teacher in a forest academy has had any training in practical forestry, or that the forester educated in a *Hochschule* shall prove a mere theorist. The assumption that the foresters of Baden, of Hesse, or of Switzerland are inferior in practical skill and efficiency is not in accordance with fact. It is acknowledged on all hands that the forests in these lands are well managed. And he argued that if the one class of institutions produced men equally skilful in the practical application of the acquired knowledge as did the other, it was desirable that the more extended instruction of the *Hochschule*, or of the universities, should be obtained; and that it was no advantage, but the contrary, for the practical man to have no information on the subjects studied by him beyond those applied by him in the discharge of his duties.

He denied that it was, as alleged, the case, that the studies in the universities were too general and comprehensive; that no application of them to forestry would there be taught; and that forest academy instruction in the auxiliary sciences was limited. In the former the instruction did not go beyond what was desirable for every educated man; and it was not desirable that an impression should go abroad that students of forestry had made choice of that department of study because it made the least demand upon them. That it was not true, as a matter of fact, that the teachers of the fundamental sciences in these did not make use of illustrations from life in the forest, but that they did so whensoever occasion served; and there were in them special teachers of these special subjects, as, for example, in Giessen, where there were special instructions given in forest botany, forest entomology, and forest mensuration and surveying, &c. That it was

in the nature of things that more had been done for the extension of natural history beyond what related exclusively to forests by the numerous teachers of it, in *Hochschulen* and universities, than by the lesser number of teachers of it in forest academies; but that, with rare exceptions, these were not trained foresters, and had not in this respect any original advantage over their brethren in the more general educational establishments. In regard to the assertion that the teaching of the fundamental sciences can be more completely concentrated upon the instruction absolutely requisite to the forester in the forest academy than in the more comprehensive institutions, it may be asked, said he, Who is to effect the limitation? The teachers of these, mathematics, botany, &c., might not, and would not, feel any particular disposition to do so. They are, according to a statement made elsewhere by the introducer of this discussion, too much birds of passage to acquire a thorough acquaintance with the relation to the forester's aims of the subjects on which they teach. The general schools, said that gentleman, and pre-eminently so the universities, exercise upon those teachers a more powerful attraction than do the special institutions. Skilled men of superior attainments do, indeed, betake themselves to the forest academy that they may without any loss of time secure a name or title, and a maintenance; but these attained, they without hesitation turn their back upon the academies to get an appointment in a university, if there be a prospect of attaining there one as good or better. The speaker said he could confirm these statements; and he would add that the teachers of the accessory sciences were ready enough to do the same so soon as they felt the pressure of the director. But the director of the institution could not see to it that the proper measure of attention was given to each department of study embraced by the course, inasmuch as he could himself only possess an encyclopædic knowledge of the field embraced by the accessory sciences. The director, who had never once, perhaps, himself studied a plant with a microscope; never once, perhaps, wrought in a chemist's laboratory, could not possibly instruct the botanist or the chemist how far he should go in teaching the science he was called to impart. And as a matter of fact, the accessory sciences were not taught otherwise in the isolated forest academies than they were in the *Allgemeine Hochschulen*, as one may satisfy himself by comparing the *Stunden pläne*, or published arrangement of lectures on each day in the two kinds of institutions.

The speaker said he hoped he had thus shown that the advantages alleged to be connected with study at isolated forest academies had no existence in practice, and that these institutions could not in any instruction compete with the *Allgemeine Hochschulen*. The special professional schools did not turn out better practical men; they were not supplied with

better districts for excursions; and in reference to the accessory sciences they had nothing to offer superior to what was provided by the *Allgemeine Hochschulen*; while, on the other hand, many of the *Allgemeine Hochschulen*, because of their being situated in more interesting forest regions, are much better suited to be the seats of instruction in forest science than are some of these; and experience has shown that in them instruction can be given in the accessory sciences without any detriment to the instruction given in special professional subjects; in addition to all this, the instruction in the accessory sciences can be given at no additional expense to the State, and can thus relieve the treasury of the forest school of this, and leave it free for the prosecution of experiment and research; so that, in point of fact, no reason whatever exists for the continued maintenance of isolated forest educational institutions, for which the improved conditions of the forests and the superior education of the forester no longer make any demand.

In such circumstances, continued the speaker, one may be surprised at the fact that the transference of forest instruction to the *Allgemeine Hochschulen* has not been made ere this, and that in certain districts the local combination of the forest schools with the *Allgemeine Hochschulen* has not been adopted. The allegation so often heard in connection with discussions of this subject, that town life would imperil the morality of the youthful forester, surely cannot be advanced in earnest: when the students of theology are, without any concern as to their morality, allowed to study at the universities, the student of forest science may be left to defend himself. There must also be something else than this in connection with the *Allgemeine Hochschulen* which is dreaded, that the forester must be kept from these whatever the expense may be. And if we would get at this stumbling-stone, it is not far to seek nor ill to find. It is the spirit prevailing at the *Allgemeine Hochschulen*,—it is the atmosphere of liberty pervading the school, which it is considered would be detrimental to the forester. It seems to be held that at the isolated institution more submissive forest officials will be trained!

The speaker proceeded to throw light upon certain proposals which had been made for such a combination of the instruction in *Allgemeine Hochschulen* with that given in isolated forest schools as would be effected by students attending both, but successively, first the one and then the other; and he showed the unsatisfactory character of such an arrangement. Thus, for example, said he, it would not serve the purpose for the forester to be allowed to go to the *Allgemeine Hochschule* to complete his studies after having attended the forest school: the expenses to him of his education would be increased, and a privilege would thus be created for the rich; and it could bring no compensating advantage to the forester to go through the study of the foundation

sciences a second time, and that after having given attendance on the lectures on forestry. If there is to be a logically defensible order of study followed, the attendance at the *Allgemeine Hochschule* must at least precede the attendance at the forest school; but neither from this arrangement is help to be expected against the evils alleged to attach to the present mode of education of foresters.

Twenty years ago it might have been a suitable arrangement to make the transference from the *Allgemeine Hochschule* to the forest school one of gradation, by making the one a preparation for the other; but now that the fit time has passed, and already in Bavaria the combination of forest instruction with university studies has been effected, and become a settled matter, the proposal comes too late. We cannot now be satisfied with half-measures, but we must demand the entire and undivided advantages of the *Allgemeine Hochschulen.*

At the conclusion of his address, which had been frequently interrupted by vehement applause of the assembly, the speaker expressed a hope that the congress would pass a resolution to the effect "that the isolated forest schools were no longer sufficient for the education of officials to be entrusted with the management of forests, and that in these circumstances there was a pressing necessity to transfer the instruction in forestry to the *Allgemeine Hochschulen.*"

Before the introducers of the discussion had commenced the delivery of their addresses several gentlemen, all from Prussia, had announced their intention to speak in defence of the maintenance of the special professional schools. It was now proposed, and agreed to, that as in the meantime a great many friends of the *Allgemeine Hochschule* had added their names to the list of intending speakers, speakers *pro et contra* should alternately address the meeting.

Then spoke in succession Dr. R. Hartig, Professor in Neustadt-Eberswalde in Prussia; Oberförster Heiss, from Neustadt in the Palatinate; Oberförster Ilse, from Beurig-Saarburg, near Treves; Förstmeister Ganghofer, from Würtzburg in Bavaria; Förstmeister Bando, from Neustadt-Eberswalde, in Prussia; Dr. Borggreve, Professor in Bonn (Poppelsdorf), on the Rhine. Dr. Lothar Meyer, Professor in Carlsruhe, in the Grand Duchy of Baden; Dr. Gerstner, Professor in Würtzburg, in Bavaria; and Professor Dankelmann replied.

Thereafter the President desired those who wished to give their vote in favour of professional school instruction in forestry being combined with that given in the *Allgemeine Hochschulen* to stand up, when the whole assembly seemed to rise with loud cheering. Then those who were in favour of the continued maintenance of separate schools of forestry were requested to stand up, when sixteen members of the assembly stood up. Thus was the decision of the congress given in

favour of the former arrangement, after sitting from eight o'clock in the morning till half-past two o'clock in the afternoon, with only an hour's intermission.

All the arguments advanced *pro* and *con.* in regard to the advantages and the disadvantages of foresters being educated at a university or at a separate special school, speak of a very different state of things from what prevails in Britain; but the question may be considered more dispassionately when looked at apart from any personal views or interests held by the reader.

There has lately been issued the Report of a Royal Commission on the Scottish Universities, the discussion of which seems to me to present a good opportunity for proposing that, with the changes suggested by the Commissioners, provision should be made for the study of Forest Science in some one or other of these universities. The coincidence of the printing of this paper in the same month with the publication of that Report was altogether undesigned.

I have seen no reason to recede from anything I have advanced in the Plea for the creation of a school of forestry in connection with the Arboretum at Edinburgh.* This much I consider it proper to state. But beyond this I have no desire to argue the matter at present, and I consider I am equally serving friend and foe to such an arrangement by supplying such information as is embodied in this paper to those who might not otherwise have access to it.

* Reviewed in *Journal of Forestry*, Vol. I., No. 1, pp. 48—56.

THE ORIGINAL RIBSTON PIPPIN APPLE TREE.

The following account was furnished in 1818 by Sir Henry Goodricke, Bart., of Ribston, near Wetherby (the owner of the tree), to Frederick Lumley, Esq.

Traditionary accounts, he observes, are all which we have to guide us in the history of this tree. It is said that some pips were brought from Rouen about 130 years ago; that they were sown at Ribston; that five of the pips grew, two of them proving crabs and the other three apples, which were all planted out at Ribston. Two of the apple trees are now growing and produce fruit, one of them the celebrated Ribston Pippin, which was blown down about the year 1810. The bark having been previously injured by cattle, the tree had decayed, so that the wind fractured the stem about seven feet from the ground, the head and branches hanging by that part of the bark which remained sound. In this position it yet remains, sending out fresh and vigorous shoots in new directions. It yet bears fruit, but in decreased quantity, size, and flavour. For several years it had not at any time produced a peck of apples. The year before it was blown down it produced between three and four bushels, and when in its prime which is within the memory of many persons now living (1818), it was reputed a good bearer.

Hints on Oak Barking in Ireland.

By D. SYM SCOTT, Forester, Ballinacourte, Tipperary.

In this country small bough and copsewood bark will scarcely sell at any price, and is therefore hardly worth the cost of stripping. Tanners, however, are ever ready to give a fair price for well-saved bark of good quality, taken from trees forty to sixty years of age. This quality of bark has a reddish colour in the heart, and will give two "waters" of ordinary strong tanning liquid. It realizes from £6 10s. to £7 10s. per ton, according to the distance from a railway station.

Many foresters are in the habit of delaying the very important work of peeling oak until about the middle of May. This is in my opinion a mistake. I prefer to commence operations as early in the month of April as the bark will rise, choosing of course such trees as are most advanced to begin with. Before felling the tree I remove about four feet of the bark from the butt to make way for the axe, men or fellers; taking the bark off as low down as possible, even going below the surface of the ground after it when necessary. For this part of the work I employ a boy or two at so much per day, but for peeling the rest of the tree I allow fourpence per cwt. of bark.

When the tree is felled the peelers, working in pairs, clean off the moss and cut the bark into lengths before raising it with the barking irons. Sometimes small mallets are used to "hammer" the bark with to expedite its removal, but this discolours the inside, giving that black appearance objected to by the tanner. Much pounding with the mallet should be avoided. Every day's produce must be weighed and secured in the evening of each day, the weighing to be under the immediate superintendence of the forester, or, in his absence, the foreman. Weighing the bark every day may by some be considered tedious, but a little practice will facilitate the work and secure great accuracy.

The bark stands should be erected in open, airy situations, and thoroughly exposed to sun and wind. A trustworthy man should attend to the proper putting up of the bark. He should provide forked stakes from two to three feet long, which are fixed firm in the ground, and have long small poles stretched along their top, lying in the forks. On these stands the bark is laid, taking care that the inner side of the bark is in every instance downwards, with the huge whole pieces nicely laid on the top, as thatch to ward off the rain.

If the weather is at all favourable, I go over the stands at the end of

three weeks and turn over the bark, so as to admit the air more freely. In a week or ten days afterwards what is well cured of it I put into a rick or stack.

I build my rick also in an open airy place, where it will catch the wind. The rick should not be more than seven feet broad at the bottom. A long narrow bark rick is much to be desired; additions can always be made to the length without interfering with what is already put up; the only points to be observed in building a rick are to keep the heart well filled with the best saved material, and to give the pipe-like outside a downward tendency, which prevents the lodgment of rain-water. The top of the rick should be as perpendicular as possible, and may be protected with spruce branches or ferns.

Chopping bark is now done with machinery. A chopper is an exact imitation of a chaff-cutter with round smooth feeding rollers, and is driven by a donkey or a mule. Tanners generally buy the bark in the rick, and chop it themselves.

Instead of being particular with the time for beginning peeling oak, I think we ought to be more exact than we are with the period when to leave off. When the trees get into their full vigour of growth the sap is highly rarefied, and being volatile, the bark suffers from extreme evaporation. I endeavour to finish all cutting of oak by the middle of June, and I am always very careful not to allow the bark to get bleached with the rain, or dried up with the sun beating upon it.

Forest Seeds from California.—The systematic efforts at forest planting that several foreign Governments have entered upon are the source of a new trade from this country. An export of forest tree seeds from California has been established amounting to $10,000 per year. The principal purchases are made for Germany, Austria, England, and the colonies in Australia and New Zealand; at present the demand exceeds the supply. The seeds of the Oregon pine, known also as the yellow fir, are most sought; the timber of that tree is as good as British oak for shipbuilding, and has been found sound after 18 years' use for this purpose. The South Sea colonies are planting the California redwood tree extensively.

Large Beech Tree at Gormanstown Castle.—A correspondent of the Irish *Gardener's Record* gives the dimensions of a very fine beech tree growing in the demesne of Gormanstown Castle, co. Dublin. The trunk at six feet from the ground measures something over ten feet, and immediately above that height it forks into a number of branches, the horizontal ones radiating symmetrically from the trunk for some 18 feet, at which point they touch the ground, on which they rest for a nearly equal length, before turning up and again assuming a horizontal position. The circumference of the branches is 299 feet, and the height, as near as he could judge, from 85 to 90 feet. The tree is in a healthy condition, and yearly adding to its already ample proportions.

The Improvement and Management of Grass Land.

By ANDREW SLATER, Wyreside Cottage, Lancaster.

This is a subject of much importance to many who are connected with rural pursuits, but in numerous instances it does not receive the attention it deserves, as is amply exemplified in various parts of the country, by the neglected-looking appearance of large tracts of land, which by a moderate expenditure, judiciously laid out in drainage and manure, might be brought to a high state of productiveness.

A system of thorough drainage must be adopted with wet pastures, which in itself will to a certain extent improve them, as all stagnant water lodging in the land is drawn off, and rain-water can then percolate down through it, washing out of the soil in its passage any deleterious matter that might be hurtful to vegetation, and also leaving in its descent any fertilizing material it may contain in solution, which will be absorbed by the roots of the plants. A complete change of grasses will be the result, and the soil is brought to a higher temperature, which forces the grasses earlier in the season and hastens their growth; the soil is also brought into a fit state for receiving manures. On newly drained pastures, if the land is sour, or if it contains any inert vegetable matter, a top dressing of lime will prove beneficial. It supplies the lime which is necessary for plant growth, and combining with acids in the soil, removes the sourness of the land; also, by acting on vegetable and mineral matters in the soil, it changes them into soluble food for plants.

Lime should be applied after being exposed to the weather for some time, as it is said to have a more lasting effect than if put on when newly slaked. On cold stiff land, instead of laying on lime by itself, it should be formed into a compost by mixing it, before it begins to fall, with decayed vegetable refuse, cleanings of ditches, or any suitable material that can be had: the heap should lie for two or three months, and be turned a few days before applying it. After being applied it should be harrowed with a chain or brush harrow, and then rolled.

By the constant depasturing of cattle grass land will gradually deteriorate, as a certain amount of fertilizing material is daily carried off in the form of flesh and milk. It is therefore necessary to keep up the fertility of the land by substituting something equivalent to what has been taken off. There are various chemical manures to be

had for that purpose, but bones are extensively used, and they effect a wonderful change in the quality and nutritiousness of the grasses. They are to be had in different forms, viz., in inch, half-inch, quarter-inch, in dust, and in a dissolved state. The larger size has the most lasting effect, but they do not act so quickly as the dust or dissolved bones. They are sown broadcast on the land, and in most cases one ton of the rough bones will be a fair dressing per acre; a less quantity of the dust or those in a dissolved state will do, as they become exhausted sooner, and require to be oftener repeated.

Feeding sheep with rich artificial food—such as oil or cotton cake—on pastures, has also a decided effect in improving the herbage; the feeding troughs ought to be shifted daily, and gradually worked all over the field, so that every part of it will be alike benefited.

When the pastures are stocked with cattle their droppings should be spread over the ground at least once a week; the most of the enclosure will thus in time receive a top dressing, and no unsightly tufts of rank grass will be dotted over the field, as would be the case if the excrements were left untouched.

Rank weeds in pastures ought not to be allowed to seed, they should either be rooted out or cut over, and rushes on newly drained land should be frequently mown; their functions will be thus weakened, and they will gradually die out.

At gateways, where the cattle are likely to congregate and tread the ground into a puddle, it would be an advantage to cover a certain area near them with a thick coat of broken stones; they would soon consolidate, and the grass in a short time would spring up through and entirely cover them.

Such is a brief outline of some of the means taken for renovating and keeping up the fertility of grass land, and I should be highly gratified to see the subject thoroughly discussed in the pages of this Journal.

Coal Tar on Fences.—I notice your comments on the *Journal of Forestry's* instructions on the preserving of fence-posts. You say at the conclusion that "it must be remembered that coal tar does not do well on wood exposed above ground to sun and weather." On the farm on which I reside we have over 700 yards of tarred picket fence, put up 20 years ago, to the most of which coal tar was applied. I have just made a close examination of the fence, and find that nearly the whole of the tarred portion is sound, while a few panels that never were tarred are much decayed and in need of repair. The tar was applied to most of the pickets by dipping them into boiling hot tar some time before they were nailed on. The posts and railing also received a coat, put on with a brush. There is a great deal of tarred fence in this country, and all that I have ever seen appears to be outlasting the untarred.—R., in *Albany Cultivator.*

Wayside Jottings.

By W. STEVENSON, F.R.H.S.

I.—Gains and Losses of the English Language.

"Greens." What have we to do with greens? We are not vegetarians, nor do we wish to make use of our columns for the benefit of market gardeners; then what, the reader will exclaim, do we mean by introducing such terms into the columns of this Journal? Our answer is, we claim it as a term connected with trees and woodland scenery, one largely used by the best scholars and the most polished writers of the last century, but one that has slipped out of our sylvan vocabulary, and become a thing of the past during the last seventy years.

Bailey, in his dictionary, which was a standard work of the English language in the last century, informs us that trees and plants requiring the protection of greenhouses were called "choice greens," and Pope, in the following extracts, makes such frequent use of the term in the sense that we indicate that we have no hesitation in claiming for it a place in connection with sylvan scenery:—

> "A spring there is, whose silver waters show,
> Clear as a glass, the shining sands below;
> A flow'ry lotus spreads its arms above,
> Shades all the banks and seems itself a grove,
> Eternal *greens* the mossy margin grace,
> Watch'd by the sylvan genius of the place."

Speaking of Melancholy as she sits in the twilight groves, he says:—

> "Her gloomy presence saddens all the scene,
> Shades every flower and darkens every *green*,
> Deepens the murmur of the falling floods,
> And breathes a browner horror on the woods."

It might be argued that the poet in this case alluded to the green herbage in the same sense that Sir W. Scott does in the following:—

> "Nor wilding *green* nor woodland flower
> Arose within that baleful bower,"

but that the term was extended to forest trees we have incontestible proof in the following lines by Pope:—

> "To paint anew the flow'ry sylvan scenes,
> To crown the forest with immortal *greens*."

Of all the studies that carry amusement in their train, perhaps none are more engrossing than the gains and losses of our language. In the present note we have drawn upon recent times; but if we travel to the past, the changes are more marked and forcible in their character.

The art of "building" was anciently called "timbering," and hence we are told that York cathedral was *timbered in stone;* again "thatching" was the equivalent of "covering," and we find it stated so late as four hundred years ago that some buildings belonging to Worksop Priory were *thatched with stone.*

The Liriodendron.

A FEW notes from its native wilds upon this valuable tree may be of interest to your readers. The tulip tree, or poplar, as it is generally termed here, is one of our most common as well as most useful trees for ornament, shade, and lumber. Within the last decade, millions of fine specimens of this grand tree have been ruthlessly destroyed and cut into the lumber which constitutes the major part of many a cosy home. Timber is no object, and the destruction still goes on; portable mills are plentiful, and in a score or two of years this beautiful specimen of nature's handiwork will have disappeared from our forest.

It seems most congenial to hilly, broken land, where it attains its greatest size. The valleys and hills of the Ohio and Mississippi seem to be its native home. Wood, in his botanical works, gives an account of a tree 23 feet in circumference four feet from the ground, and 125 feet high, growing in Indiana. Fifteen years ago, when thousands of acres that are to-day in grass and grain were in all their primeval woodland glory, broken only here and there by a small farm, there was a tree a mile or so from my father's house in this county, 10 feet in diameter and 140 or 150 feet high. Alas! the woodman spared not that tree, and this king of all its race has gone the way of all things earthly! Trees four and five feet in diameter are abundant. The kind known as white or blue poplar is very tough, and will not split; the yellow kind makes good rails, shingles, &c., and above ground compares favourably with our best lasting woods, but will soon rot in the ground.

Another feature, and a very important one too for shade and ornamental trees, is that it is one of the earliest to put forth leaves, which quickly grow to their full size. They are now (April 21st) about one-third grown, and already make quite a shade. The leaves are very graceful, dark green, smooth, truncate at the end with two lateral lobes, on long drooping petioles; are from 3 to 5 inches in length and breadth, and when held in the sun have the appearance of being bronzed, something like the Southern magnolia. The flowers in dry weather accumulate several drops of honey on the petals and sepals, and are generally sought after by the average small boy, bees, and animals that have a sweet tooth. Young trees 10 or 12 feet high are often replanted, after trimming the tops, and few die.

Large Trees on Murthly Estate.

By D. F. McKENZIE, Forester, Murthly Castle, Perthshire.

There is nothing remarkable in the history of the trees in the following list so far as the writer is aware of, except that a few of them have seen at least four centuries come and go, and are still healthy and vigorous trees. Many of them have lost limbs of great size by storms. One great beech had a limb torn off about a year ago which weighed nearly five tons, and except that the tree appears somewhat one-sided, the limb is scarce missed. Another of the same species, which has long been threatened with dissolution, is strongly cramped with iron straps and stays to keep the limbs together.

Excepting the Scots firs, the whole are park trees, and all bear the marks of neglect in both the earlier and later stages of their growth.

The whole are growing on a rather light sandy soil, resting on a deep gravelly subsoil, at an elevation of 180 feet above sea level according to the Ordnance map, and freely exposed on all sides. The average height of the hardwood kinds will be 60 feet, excepting the limes, many of which are 100 feet in height and at least 200 years old. The only remarkable tree in appearance is the larch, whose girth is 9 feet 8 inches, with a bole 15 feet in length; the entire height of the tree is 35 feet. The branches are all drooping, and spread 70 feet. The tree is almost flat on the top, slightly convex, giving to the tree at a distance, when in full leaf, the appearance of a huge green mushroom. This tree is the only remaining one of a long line cut down some years ago, and was thought to be not worth remaining along with the others. Some of the stools of those cut down measure 4½ feet across. The trees were all sound and the quality of the timber appears to have been excellent.

The silver firs are all handsome specimens, from 70 to 90 feet in height, and are of various ages, the largest being about 100 years old, and all growing vigorously.

The measurements are all taken at 5 feet from the ground, and when two of the same size were met with only the best specimen was measured. They are in circumference as follows:—

Eight beech trees, 16 ft. 6 in., 15 ft. 8 in., 15 ft. 3 in., 14 ft., 13 ft. 6 in., 13 ft. 5 in., 10 ft. 10 in., and 10 ft. 3 in.

Seven wych or Scotch elms, 13 ft. 6 in., 12 ft. 10 in., 12 ft. 7 in., 11 ft. 9 in., 11 ft. 3 in., 10 ft. 3 in., and 9 ft. 9 in.

Two oaks, 18 ft. and 10 ft. 4 in.

Two Spanish chestnuts, 17 ft. 7 in. and 15 ft. 10 in.

One horse-chestnut, 12 ft. 5 in.

Two planes, or sycamores, 19 ft. 6 in. and 10 ft.

Ten limes, 10 ft., 9 ft. 10 in., 9 ft. 7 in., 9 ft. 3 in., 9 ft. 2 in., 9 ft. 1 in., 9 ft., 8 ft. 11 in., 8 ft. 6 in., and 8 ft.

Twelve silver firs, 12 ft. 4 in., 11 ft. 5 in., 10 ft. 10 in., 10 ft. 7 in., 10 ft. 6 in., 10 ft., 9 ft. 5 in., 9 ft. 3 in., 9 ft. 2 in., 9 ft. 1 in., 8 ft. 9 in., and 8 ft. 7 in.

One larch, 9 ft. 8 in.

Three Scotch firs, 10 ft. 7 in., 10 ft. 5 in., and 8 ft. 6 in.

In all, forty-six trees, containing in the aggregate, by random estimate, 14,000 cubic feet measurable timber, besides about 300 loads of firewood. Of course the measurement includes large limbs; otherwise it would not exceed two-thirds of the above statement.

The writer hopes that others may be good enough to give similar statements, and no measurements of *common* trees be less than 8 feet girth.

Presentation.—A very pleasant evening was spent the other day on Lord Bective's Derwent estate, in Westmoreland, when a handsome testimonial was presented to Mr. F. Punchard, his lordship's agent, by the tenantry of that township, "as a mark of their admiration of the manner in which, as agent of the Underley estate, he combines fidelity to his trust with consideration for his tenants."—*Agricultural Gazette.*

Destroying Stumps.—How can I destroy the vitality of tree stumps, the object being to cause early decay, save expense of cutting annual shoots, and by reserving some of the best young trees, and sowing to grass, to convert in time a piece of woodland into a park?—C. D. [If the stumps are dead, pile turf or soil on the tops, which will tend to rot them. If alive by sprouts or suckers, cut or tear them off early in summer, or while in vigorous growth, and proceed as before. Some of our readers may have had experience in this line, and may be able to give better advice; if so, we invite them to furnish the results.]—*Albany Cultivator.*

The Rothesay West Bay Esplanade.—A great improvement is going on in breadthening the pavement and levelling up the road along Argyle Street, as well as finishing off the Esplanade in front with large trees of many years' growth and standing 20 or 30 feet high. These trees are the gift of Alexander B. Stewart, Esq., to the town from his grounds at Ascog Hall. They are planes, and finely grown trees, and will at once give a finished aspect to the Esplanade. They have been transplanted by the machine invented by Mr. James Kay, forester to the Marquis of Bute. Mr. Kay is superintending the work, which, it is needless to add, is remarkably well done.—*Rothesay Chronicle.*

ENGLAND.

THE advice given in the editorial note for March, respecting clearing plantations of all "dead and decaying wood and fallen *débris*," should at once be acted upon by every forester who wishes to maintain a healthy state of vegetation in his woods.

Though the transplanting of hardwoods in the nursery will now be finished, conifers will still require attention, and may yet be planted out with success. The great point to attend to now is quick removal and as little exposure of the roots as possible. The advantages of a good puddle for the immersion of the roots before transit have been very manifest during the prevalence of the cold and drying winds of March.

The work of the nursery will still demand great attention, to finish the sowing of seeds, raking over beds lately sown, hoeing among the rows to keep down weeds, and loosening the soil between the rows to promote the growth of fibrous roots.

Should frosts come, it will be well to cover up beds of recently planted beech, ash, chestnut, sycamore, and also to protect seedling hawthorn, silver fir, larch, and spruce, by sticking in sprays or cuttings which will partially shelter them, and prevent the sun striking the young plants in the morning while the frost is on them.

Where the grafting of forest trees is practised, operations upon the elm, oak, and beech may now be finished. Upon the common oak the Fulham and Lucombe may be grafted; and the Norway maple, or even the common sycamore, may receive grafts of the rare or variegated kinds. The wonderful variety of its tints and the beauty of its soft cloud-like outlines render the maple a great ornament to the park, the avenue, or the plantation. The stocks selected for grafting upon should if possible be from 20 to 30 years old.

During very dry or frosty weather the dead branches of the larch, spruce, and silver fir may be pruned off by dealing them a smart blow near the trunk of the tree with a stout cudgel, as such branches are then brittle: this causes the loosening and withdrawal of the dead

bolt-like insertions, which, if left in the trunk, prove so injurious to the timber.

The pruning and trimming of all evergreens, whether shrubs or hedges, may be proceeded with. Whin or furze seeds may be sown either in the nursery or where required for permanent hedges or cover. Fences formed of this should only be trimmed once a year, and that between the middle and end of June.

April is a good month for sowing grass seeds upon wood-rides, or for game cover in situations where the shade is either light or dense. Select seeds according to the situation, and having secured a firm bottom and fine surface, cover in as lightly as possible. Much of the seed usually sown is lost from being too deeply buried.

Should warm weather set in, the falling of oak and bark-stripping will in the south demand all the forester's attention before the end of April. This is an operation of such importance that all other forest work must give way to it. Watch closely the falling to prevent damage to the standing timber, and allow as little hammering of the bark as possible. See that the smaller branches down to about one inch in diameter are stripped. The drying and harvesting will also require close attention, to prevent mouldiness in a wet season, and over-drying and consequent loss of weight in hot weather. Expose the inside to the sun and rain as little as possible, and deliver or stack as soon as the bark becomes brittle.

The middle of April is perhaps the most favourable time for sowing coniferous seeds. The practice of laying the cones upon the beds, to open and shed their seeds under the combined influence of heat and moisture, is a very slovenly one, and uncertain in its results. By far the best way to extract the seeds is to place the cones upon a kiln (a hop-oast is well adapted for this purpose), and if they are spread upon the hair about 7 or 8 inches thick, and a regular heat of not more than 110° Fahrenheit kept up for ten or eleven hours, they may then be removed to the thrashing-floor and beaten out by the common flail.

Among the spruce forests of the Hartz Mountains kilns are kept up by the Government, whose officers receive the cones from the men who gather them by contract. There it is estimated that one bushel of the cones will yield $1\frac{1}{15}$ lbs. of the seed when divested of their wings.

As a guide to those sowing coniferous seeds we may state that a sample of average quality produces under favourable circumstances of soil and climate about $\frac{2}{3}$ of good germinating seeds; also that about 1,000 seedling plants to the square yard is considered fair nursery space. The approximate number of seeds contained in 1lb. of each of the different

kinds is as follows:—Scotch pine, 69,600; larch, 63,900; spruce, 61,400; Weymouth, 30,600; Austrian, 23,800; silver fir, 15,600; pinaster, 11,150.

If not already planted, the seeds of the beech,* alder, and birch should immediately be got into the ground.

Larch seeds may be sprinkled with water for a few days before planting. They should be lightly covered, having less than half an inch of soil over them; and they will require netting or closely watching.

Osiers for basket-making may be planted up to the first or second week in April. Choose land which abuts upon a stream, so that water may be admitted into the bottom of the open ditches or shut out at pleasure by means of a sluice. Take cuttings of 12 or 14 inches long, from straight branches of two years' growth, and plant in rows of from 1½ ft. to 3 ft. apart, and 16 to 24 inches between the cuttings, according to the growth of the osier. Insert the cutting about two thirds of its length, and cut it down to the stub at the end of the first year. By the end of the third year they will attain their full strength, and afterwards admit of yearly croppings. *Salix viminalis, S. rubra,* and *S. Forbyana* are considered good sorts for the basket-maker. The preparation of the ground for osiers should comprise deep trenching, 24 to 30 inches, liberal manuring, and thorough cleaning.

Transplant large-sized hollies for hedges, taking them up with a good ball. Uncover and water beds of birch seed in dry weather, undercut roots of seedling oak; and remove seedling acacia, giving them ample space and liberal waterings.

All coppice wood should be removed before the bark-stripping commences. Secure withes for tying up oak-top fagots, and prepare materials for drying sheds for bark, should such be required. A light portable framework and some sheets of thin corrugated iron will be handy for removal and re-erection.

Finish as quickly as possible the repairs and plashing of plantation hedges before cattle are turned into the adjoining pastures.

Pluckley, Kent. A. J. Burrows.

SCOTLAND.

April may be considered the month when the annual routine of forest work should be wound up for the year. In all probability there will be arrears in various departments to bring forward, and no effort should be spared to get these attended to before commencing the important business of oak stripping.

Continue the trimming of box and holly hedges. When raking up the cuttings, all dead and withered leaves should also be drawn out

* In the notes for March "beech seeds" was misprinted "*buck seeds.*"

from the bottom of the hedges, as these often afford shelter to mice, whose ravages in the surrounding fields and gardens just now are too well known to need any comment.

The cutting in of ivy on walls, &c., should now be proceeded with. Unless this work has been neglected, it should be done with a pocket knife. Ivy as a rule should be cut every year; by that means it is kept close to the wall, and always presents a uniform surface of green.

The pruning of all evergreens should be completed this month; and as was mentioned last month, every precaution ought to be taken to prevent cattle or other animals getting access to the cuttings taken off the shrubs. Let them be collected and burnt as the pruning proceeds, so as to avoid danger and accidents.

See that all newly planted large ornamental trees and shrubs are securely staked to prevent them being blown about by the winds. Also see that all such trees and shrubs have a plentiful supply of water, when necessary, until they are fairly established in the soil.

The planting of all Scots fir, spruce, and other pines, should be completed without delay.

Nothing is gained, but much risk run, if the operation is delayed till so late in the spring. Hot dry weather setting in causes the soil to crack and open around late planted forest trees, especially if notched in, and the consequence is many trees perish from the drought, that might have been saved had they been planted in time to allow the soil to settle closely about their roots.

Look over the fields that are to be pastured, and make all the fences secure, for if sheep or cattle once find their way through a fence, there is often great difficulty keeping them in afterwards. All hurdles used for temporary fencing during winter, for sheep eating down turnips, &c., should be carted home and stored away in a dry shed for another year. Those fields which are to be turned into meadow hay this summer should not only be fenced to keep out stock, but where game is plentiful a wire net should be also run round the fields, as these animals not only eat large quantities of the grass, but also pad down with their feet large tracts in the field, which make it exceedingly difficult to cut.

Keep a sharp look-out on the oak trees towards the end of the month, and on the first indication of the bark rising freely, no time should be lost in beginning the peeling operations. In view of this coming on, it will be necessary also to look out for a squad of peelers, and make other necessary arrangements so that the work may go on smoothly and expeditiously.

In the nursery complete the grafting of ornamental trees. Look over those previously grafted, and repair the clay where it has cracked with the sun.

Finish all transplanting of seedling trees and other nursery stock.

Fork between the rows of all trees not removed or transplanted this season. Keep the hoes going to prevent weeds getting a-head.

Sow the seeds of all coniferous trees towards the end of the month, and immediately net them over to prevent the birds taking them. Old herring nets are the best and cheapest material for this purpose. ROBERT BAXTER.

Dalkeith Park.

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IRELAND.

The month just ended has been a very favourable one for vegetation, and everything is far advanced for the season of the year. The forester will now in addition to the general routine of forest work given in previous numbers of this Journal, have to make preparation for commencing barking operations. We have for some years past begun as early this month as the "sap is up," and found tanners particularly fond of our bark. Examine the trees before they are felled, by nserting below the bark a barking iron, and only cut those sufficiently advanced to admit of the bark being removed without much labour in pounding with the mallet. Tanners in this country are very choice in reference to the quality of the bark, preferring a thick rind of a reddish colour. It is very difficult to save bark in our moist climate, and great care must be used in selecting an open exposed place as a bark yard. The bark ought to be thinly laid together when drying, and when cured put into a rick with as little delay as possible.

Select the first fortnight of this month as the proper time for pruning oak copse. In attending to this work preserve such shoots as are most perpendicular and lowest down on the stock, cutting away all side and straggling spray. Four or at most six stems, if equally distributed round the old stool, will be a sufficient crop to leave, and these ought to be straight and well pruned.

It must not be forgotten that in many parts of the country young plantations suffer severely from an overgrowth of ferns. This evil can easily be remedied about the end of the month by attending to the worst places, and breaking off the top of the tender ferns with a small wattle. When done at this season the cost per acre is a mere bagatelle.

Early in the month sow beech and other seeds if not done before. Towards the end, sow firs and larch. Before sowing small seeds it is well to poison them, to prevent birds damaging the beds. If the seed is moistened and mixed with a little red-lead, birds will shun the beds. We have adopted this plan for many years, and always found it most effectual.

Now is the time for the forester to multiply his stock of rare and ornamental trees by grafting. There are a great many methods of put-

ting on grafts, but crown grafting is the simplest, and we believe the most common. The great success of grafting lies in placing the two inner barks neatly in contact and excluding the air. In grafting we would recommend the following wax to put over the matting instead of clay:—four parts of rosin, one part of beeswax, and one part of tallow melted together, well mixed, and applied hot.

During fine weather sow furze seed on the top of ditches, round newly-formed plantations. Between six and seven pounds of seed will sow one mile of a single line. If for feeding purposes sow broadcast thirty pounds of seed per Irish acre.

Ballinacourte, Tipperary. D. Sym Scott.

WALES.

The present month is not unfavourable for transplanting evergreens, providing they are raised with good balls of earth, and immediately transferred to their new site, and planted at once in moderately sheltered situations. Newly transplanted trees or shrubs of moderate size should be securely staked or moored with cord or wire, to prevent their being blown over, or the roots shaken by the wind.

Look round all young and recently planted trees, and where they have been blown about by the wind, have them put straight and firmed, which is easily done by a stamp with the heel of the foot; or where they have been much swayed, and a hole round the collar, add a little soil before stamping. If such plants are not attended to the bark soon gets chapped and broken by the friction as the ground gets hard.

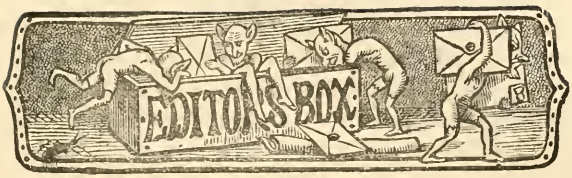
Continue repairing fences and protections of all sorts as last month.

Should we be favoured with mild and warm weather, bark stripping may have to be commenced before the end of the present month; within the last ten years we have generally commenced to peel oak in the month of April, but last year we were considerably later than usual. However, under any circumstances it will be well to be fully prepared to proceed with the work, by having all tools and other preparations made ready in due course, and avoid delays and drawbacks after the work commences.

Continue transplanting evergreens in nursery, if not already finished. Dig and hoe between plants that have stood over a year in the rows; and level and rake in the course of a week after.

Hoe and clean carriage drives and gravel walks, and mow lawns and pleasure-grounds, also hoe and rake beds and borders, and prune laurels, &c.

Kinmel Park, Abergele. Lewis Bayne.



[*Correspondents sending letters signed with initials or fictitious names are requested to enclose their name and address, as otherwise their communications cannot be inserted.*]

UNDER FORESTERS.

SIR,—I am glad to see some of my younger brethren, professionally speaking, have had the courage to appear "in print" in the pages of the *Journal of Forestry*, and to so ably expose some drawbacks to an otherwise very attractive, healthy, and enjoyable profession. The thanks of all "under" foresters are certainly due to "Under Forester," page 721, and "A Forester's Apprentice," page 788, for the endeavours they have made to elicit information from "those who know," upon some points in the life and experiences of a forester, which are of vital importance to the welfare of the profession, and upon which I know, from dearly bought experience, it has previously been hard to obtain any information whatever. Now that we have your Journal, as a medium through which to give and receive information upon all matters affecting Foresters, I hope there is a better time for us in the near future, and that the brethren of the axe and spade will freely ventilate in your pages, which are so kindly placed at our service, any grievance from which we consider ourselves suffering, and all matters affecting our social standing and professional progress through life.

I do not intend to make any reply to the letters which already have appeared on this subject, because I can scarcely speak from personal experience, and to make suggestions might be construed into presumption on the part of one like me, holding a subordinate position, so that I will leave those matters to my superiors in station and elders in years and experience, trusting that we "under" men may read in your early numbers full and interesting replies and matured suggestions relative to the queries put in the before-mentioned letters. We will feel most thankful to have a course of procedure pointed out to us whereby we can elevate ourselves, professionally and socially, to the same platform, at least, as the other two important branches of country life, viz., Agriculture and Gardening. The two professions I have just mentioned have innumerable "Societies" and "Associations" for the furtherance of their interests, and a voluminous literature and numerous Press to advocate their principles and spread

abroad among the members a thorough knowledge of all scientific and practical matters influencing either profession. Then why should Forestry and Foresters lag so dreadfully in the rear, and be such martyrs to circumstances as are so truly described in the two letters referred to?

The only foresters' society of which I am aware, the Scottish Arboricultural Society, is located in Edinburgh, over 200 miles from where I write, too great a distance for my purse to cover, and for that reason I may seldom or never be able to attend its meetings. Till I read of it in your first number, I regret to say that I never heard of it during the nine years I have been a woodward or forester. I am not yet a member of the Society, but I intend to join it, simply because I am anxious to become a member of some professional foresters' society. I am not at all sure that I will derive any advantage, professional or otherwise, by joining it, but then I have no choice; for we have no society of the kind in existence in England; hence probably our want of the practical knowledge to cope with our brethren north of the Tweed in forestal matters.

However, a better day has dawned at last, and if we have no Arboricultural Society in old England to guide and encourage us, we have at least a *Journal of Forestry*, able and willing to promote the interests of Forestry, and to teach, direct, and cheer foresters wherever they may be found. FOREMAN FORESTER.

SIR,—I have read with much interest the letters of "Under-Forester" and "Apprentice," which have appeared in the pages of your valuable and interesting Journal, more especially as I am an under-forester myself, and I hope that my two young friends won't think too harshly of me if I write a little differently from their views. I think they are both a little ambitious, if I may be allowed to use the word.

Forestry is a profession that cannot be learned or picked up, as people generally call it, in two or three years. It requires a very long time to learn it properly. I believe there are many head foresters who, having studied the profession of forestry for the last thirty years or more, could come forward, if they liked, and say that they are still learning. For my own part, I content myself with the knowledge that "it is a long lane that has no turning," and that masters' places will turn up for all of us younger foresters in due time. I know what are the feelings of an apprentice, having gone through it myself, and it seems very discouraging to a young man, when he thinks he is ascending the tree rapidly, to find himself at the bottom again, simply because an apparently unsuccessful "Under-Forester" should write so despairingly of the profession. I should advise the "Apprentice" to try (at the end of his apprenticeship) to get under some leading forester in England, one who has a good influence with the principal nurserymen, when I think he would be likely to succeed, and have a better impression of the profession he has chosen. Master situations are not easily obtained. I have studied forestry for eight years, and been under the best of foresters, and in the leading nurseries of England and Scotland, and I still find myself an "Under-Forester;" however, I don't

give way to despair, but keep pushing onwards. I think our young friend the "Apprentice" would find his task much easier if he were to adopt the plan I recommend. Let him take for his motto the word "PERSEVERANCE," and if his first attempt in life as a forester seems dark and cloudy, the sun will shine by and by, and by steadily persevering he cannot but succeed in the end in gaining the height of his ambition.

AN UNDER-FORESTER.

BARKING TIMBER.

SIR,—Some practical articles on barking timber would be interesting to many of your readers during the spring months. Take oak peeling. Should this be commenced as soon as the sap runs? and how long can it be economically carried on? At what stage of the flow of sap does the bark weigh best? Then larch. An impression prevails that the weight of bark is much greater in the end of the season than in the beginning. Is it so? Further, what is the most economical staff of men and women for cutting or thinning say an oak wood of thirty or forty years old? The information I would like to see is for Scotland, and for properties with a limited extent of woods. W. H. M.

A LARGE BOG OAK.

SIR,—Whilst walking with Mr. Henderson, forester to Lord Digby, on the barony of Geashill, King's County, a short time ago, he called my attention to an immense oak, found by him whilst draining a portion of the bog. It was four feet below the surface, and on measuring the solid portion I found it to be 64 feet long, straight and clean, and squaring 2 feet at the top. It is lying from west to east, and is splintered 14 feet up, and appears to have been broken off in a violent storm, and precipitated a considerable distance, as no trace of the root had then been found. The sapwood has rotted away, and it is perfectly sound the whole length. At several feet beyond the top of the sound timber holes have been made, and portions of partly decomposed timber remain, showing that the tree must have been considerably over 100 feet high.

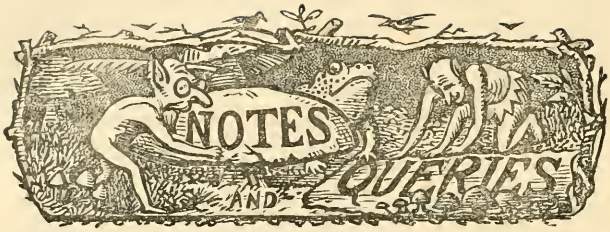
There have been also several fine specimens of the Scots pine found in the same neighbourhood. W. TOMLINSON.

Tullamore.

THE GREAT TREES OF CALIFORNIA, "*WELLINGTONIAS.*"

SIR,—W. R. in last number, page 779, thinks we are guilty of discourtesy to Americans when we call these trees by the above name, and suggests that we henceforth should call them *Sequoia gigantea.* This tree was first discovered by Douglas, in 1831, subsequently introduced by Lobb, and named *Wellingtonia* (Lindley) long prior to 1854. Although the two trees referred to correspond in some particulars, W. R. will, on closer examination, find sufficient difference to warrant both names being retained. D. S. S.

Ballinacourte, Tipperary.



[*The Editor requests the assistance of Readers in answering Queries, so that the usefulness of this Department may be maintained.*]

Squirrel Traps.—In answer to Mr. Taylor's inquiries as to the best way to trap squirrels, page 659, I remember having seen them caught successfully several years ago, by small wire snares fixed on the top rail of an ordinary post and rail fence, surrounding the plantation. A pair of pit sawyers working near the place watched the snares, and took the squirrels out alive, and sold them in the nearest town. As they are fond of running on a fence, I imagine, if there was no fence near, that a few stakes driven down, and some small larches split and nailed on the top in the plantation, and the snares fixed on, would be a successful way to catch them.—W. Tomlinson, *Tullamore.*

Plants to grow under Beeches.—"An Amateur" (page 792) will find the Silver Fir grows admirably under large Beech trees. They grow freely under shade, and are not in the least injured by the drip from above. Yew and Holly are also suited for growing in the same situation, but they are slow of growth compared to the Silver Fir.—J. Webster, *Gordon Castle.*

In reply to "An Amateur," page 792, I may state that the *Revue de l'Horticulture Belge* mentions that Boxwood, Yew, and *Ribes Alpinum* are the best plants to cultivate in shady places under trees, stating also that they are not subject to be attacked by rabbits—a matter of great importance in rearing under-cover.—P. D. M.

Barking Standing Oaks.—In answer to "Flying Scotchman's" inquiry as to whether any advantages are to be derived from barking standing oaks (see page 792), I beg to inform him that I have had occasion to perform that operation in instances, I presume, similar to that he observed, where the trees are either in hedgerows adjoining a field of corn, or in the midst of such a field. The tree is barked and topped at bark-peeling time and cut down till after harvest. By this means much less damage, if indeed any, is done to the corn by carting the bark and tops away at that time, than would be occasioned by felling the tree and allowing it to lie among the growing crop. I may add that by many the timber is considered of better quality and more durable when cut down in autumn than felled when the sap is rising.—E. C. M., *Yorks.*

In reply to "Flying Scotchman," page 792, as to why oaks are barked standing in Yorkshire, I beg to say that in such cases the fall of oak has generally been sold to the timber merchant standing, who generally considers the quality of the timber is improved by being partially seasoned on the stool, it not being so liable to split by the heat of the sun during summer. It is cut down in the following autumn and winter months. The operation is performed by placing a long ladder to the tree; then, if the tree is straight and clean, the man carries a bag of spikes hung to his belt at the back, which he drives in where there are no branches to stand upon. He carries in a loop in his belt a small axe for cutting off the branches and driving in the spikes as he goes up, leaving short stumps to stand on; he also carries a barking iron with a handle like a T in his belt, and when he gets to the top commences to strip off the bark as he comes down. There is no moss on the trees, therefore no scraping is required, as I find is the case in Ireland, owing to the dampness of the climate. A man accustomed to the work can strip from four to eight moderate-sized trees in a day, though there are generally four to six men in a gang of peelers, who climb in their turns, and while some are up the trees the others strip the branches which they have cut off. I believe the practice is gradually dying out, as it retards the cleaning up of the plantations, and is also injurious to the growth of the young shoots.—W. Tomlinson, *Tullamore.*

Holly Hedges.—If your correspondent, Mr. John S. Hall, page 792, plant quick or common thorn along with holly, the latter will close up even if planted at the distance of two feet apart. The one assists the other to grow up more rapidly, and the holly will entirely take the place of the thorn in course of time. Nip the points off the leading shoots of holly when young, to force strength into the lower branches. There are several of the same sort of hedges about this place. —J. Webster, *Gordon Castle.*

Pinus laricio.—Will some of your correspondents kindly inform me if they have found the *Pinus laricio* to be proof against the attacks of rabbits and hares? And would they recommend me to plant it where larch and Scots fir have been killed by these vermin? Also, would those who have had experience of its timber kindly say what is its market value?—*South Devon.*

Kilmarnock Willow.—Would you, or some of your correspondents kindly inform me where this striking variety of Weeping Willow originated? with any particulars of its history.—S., *Notts.*

Is Yew Poisonous?—Can you or any of your readers tell me under what conditions the yew is poisonous to cattle? A neighbour's cow died suddenly the other day, after eating (as it is said) of a yew bough, which, unknown to me, had grown through my garden hedge into the said neighbour's field. Now my cows and horses have for years and years been

able to get at the yew trees in my field, as they are quite unprotected, but I have never lost any cattle. I have heard that dried and withered yew is poisonous, but that when green it is innocuous. Is this the case? and if so, how is it chemically accounted for? In some parts of England the yew grows wild in great profusion in the hedges, coppices, and commons, but we don't hear of its killing the cattle.—R. S. B.

Measuring Trees.—Will any of your readers kindly inform me which is the best way to measure the height of a tree and the spread of its branches?—W. F. H.

Pinus Austriaca.—Can any of your readers inform me if there are any trees of *Pinus Austriaca* (black Austrian pine) *in Britain* which have borne cones containing well-ripened seed, and where?—P. A.

Paper Pulp from Wood.—Can you or any of your correspondents inform me whether the patent for producing paper pulp by grinding coniferous wood is still worked? and, if so, where I could learn all particulars? —H. J. M.

Douglas Fir for the Paris Exhibition.—There will be placed on exhibition at the Paris Exposition this year two pieces of Douglas Fir (*Abies Douglasii*). The pieces are a transverse and a longitudinal section, taken from a tree over 400 feet high and 8 feet in diameter, found growing on the slopes of the Rocky Mountains in British Columbia.

Tarring Posts.—I have lately read that pine tar was of more value than gas tar to preserve fence-posts. Do you know whether this is the case? If gas tar is used with quicklime, would not the small amount of water in the tar be needed to slack the lime, so that boiling out the water would be unnecessary? The lime could not very well be applied dry.—T. A. E. [We think gas tar as good as pine tar for preserving posts, and, unless containing a large quantity of acid, that the lime would not be necessary. Applied hot to warm surfaces of wood, without other preparation, we have found it to impart great durability when the wood is below ground, or in contact with moisture.]—*Albany Cultivator.*

Extent of Woods in England and Wales.—A return has been issued of the woods and plantations (other than saleable underwoods), rights of sporting, and mines (other than coal mines), which, by the Rating Act, 1874 (37 and 38 Vict., c. 54), were rendered liable to poor rates and other local rates leviable upon property rateable to the relief of the poor. The Act did not take effect until April 6, 1875, and the returns have been compiled from the valuation lists in force at the commencement of the year 1877. The total area in statute acres of England and Wales is 37,280,208. The estimated extent of the woods is 815,172 acres, their gross estimated rental is £307,308, and their rateable value £293,017. The estimated extent of the rights of sporting is 14,436,405 acres, the gross estimated rental £498,852, and the rateable value £485,276. The estimated extent of the mines is 1,247 acres, their gross estimated rental is £754,520, and their rateable value £654,611.—*Agricultural Gazette.*

OUR CONTEMPORARIES.

This being the concluding number of our first volume, we take the opportunity to bring under the notice of our readers a few of the leading magazines and other periodicals, amongst the numerous exchanges received by us during the past year. First to our hand come the home journals, among which the ably-conducted *Gardener's Chronicle* worthily holds the lead, as it has now done for more than a generation, in interest to landowners, and our readers generally, who are engaged in any way in the management of landed property; the varied aspects of rural economy, and of plant life and culture, being discussed in its pages with unexcelled clearness, freshness, and vigour, from week to week, in accordance with the times and the onward march of science and the cultural arts. A long-standing favourite with all who enjoy country life and the pleasures of a well-kept garden is the *Journal of Horticulture*, than which no journal of the kind is better worth a place in every country house and garden. The *Garden*, and the *Florist and Pomologist*, are well-known horticultural magazines, with the special feature of presenting their readers with beautifully coloured illustrations of new and rare plants, flowers, and fruit. The *Gardener's Magazine* is both instructive and amusing, and the *Horticultural Record* represents the cheap press in horticultural literature, being exceedingly moderate in price, and crammed full of noteworthy matter. The *Timber Trades Journal*, with the persevering energy and marked ability which have distinguished it from the beginning, pursues its course successfully in furnishing the latest information upon the home and foreign timber trade, and giving very full returns of the state of the timber market, and the prices realized at all the leading sales, as well as much general information of special value to foresters, timber merchants, builders, and others. With much energy, conspicuous tact, and ability, the *Agricultural Gazette* supports the farming interests of the country; to which important feature of rural economy the *Farmer's Magazine* contributes a due share of instructive matter. The amusement and instruction derived from *Land and Water* is highly appreciated by all true sportsmen; its pages overflow with geniality, manly enthusiasm, and good feeling. The *Journal of Applied Science* treats of every imaginable science as applied to rural economy and the industrial arts.

Our only contemporary on Forestry in the English tongue, *The Indian Forester*, Calcutta, continues to illustrate the forestry of the Indian Empire with much ability, and to disseminate an amount of valuable and instructive

matter of much interest to us at home, as well as to its numerous readers throughout India. The India Forest Department has in this magazine a persistent and able advocate of its policy. With that we do not find fault, but we have ample and good reasons for differing from both it and the Indian Forest Department about the absurd and wasteful plan followed in educating foresters to serve in India. Another Calcutta magazine of high ability and great usefulness is the *Indian Agriculturist*, being brimful of instructive information on all matters pertaining to the rural economy of India and its dependencies.

The *Revue des Eaux et Forêts* has been for many years the leading magazine on the Forestry of France, and is always full of matter of much interest and value to foresters, upon the systems of forest management carried on in France and in other continental States. *L'Echo Forestier* is the special organ of the French timber trade, and conveys much useful information on that subject to all who are interested in it. Spanish Forestry is ably represented by the *Revista de Montes*, an excellent and well-conducted journal, containing much useful information on forest science and the forests of Spain. The Austrian magazine, *Der Gartenfreund*, treats ably of botanical, agricultural, horticultural, and other rural affairs, and is held in much esteem in that country. From Vienna we also get the *Handelsblatt fur Walderzengnisse*, devoted to the wood and kindred trades of the Austrian Empire; while from Krucemburk, in Bohemia, comes *Haj* (the Forest), dealing with forestal matters in that portion of the Empire.

These European journals are only published in the language in use in the respective countries, and are unfortunately inaccessible to most of our readers, but to those who can peruse them they will well repay the trouble.

Of our American exchanges too much can hardly be said in favour of the wonderful amount of energy and ability displayed in their management, and the practical information they impart upon all matters within their scope.

The *American Agriculturist*, New York, is pre-eminent for those qualities on all subjects relating to rural life. The same remark applies to the Albany *Country Gentleman*, N.Y., in more strictly rural affairs. The *Mississippi Valley Lumberman and Manufacturer* is a valuable journal, conducted with marked ability, in the interest of the timber limits and lumber trade of the far west; this paper being published at Minneapolis, in the State of Minnesota. The *Gardener's Monthly*, Philadelphia, is an eminent horticultural authority; the *American Farmer*, Baltimore, and the *Lancaster Farmer*, Pennsylvania, are also ably devoted to the agriculturist interest; and the *Manufacturer and Builder*, New York, ably represents the engineering, chemical, and constructive arts in the United States.

To the editors and proprietors of these, and the many other periodicals which we receive, our best thanks are due for their valued and kindly exchanges.

Notes for Observations of Injurious Insects. Arranged by E. A. ORMEROD. London: Printed by T. P. Newman.

These Notes have been drawn up in a concise form, for the guidance of observers of the injuries inflicted on the food crops of the country by insects. The yearly losses to agriculturists and gardeners from this cause are something enormous, and but little has been yet done in a systematic manner, to note the appearance of any particular insect in the various parts of the country, or to prevent it ravaging the food crops to an unlimited extent. Of these losses, which tell heavily year after year both on the individual growers and the country at large, many could be prevented or remedied if more attention were directed to the subject. It is with this object in view that these "Notes for Observers" have been published, and for which the assistance of their observations is requested from agriculturists, entomologists, and others, who are either practically or scientifically interested, and can aid in the matter. The information thus obtained is to be condensed and arranged in a printed report, a copy of which is forwarded to every observer.

Any one desiring to assist in this important matter may receive a copy of "Notes for Observers" and the Report for 1877 by applying to Mr. T. P. Newman, 32, Botolph Lane, Eastcheap, London, E.C., who will also furnish sheets for the entry of any observations, such observations to be forwarded as they occur, or in October at latest, to the Rev. T. A. Preston, The Green, Marlborough, Wilts; or to E. A. Fitch, Esq., Maldon, Essex, who will give every information upon the subject to intending observers.

A list of sixteen species of injurious insects is given, upon the annual appearance of which and the ravages committed by them information is more particularly requested, and also the best methods for preventing their appearance, or destroying them when they do appear. We would like to see the list extended a little, so as to include a few of the more prominent insects which so seriously injure our forest trees, and upon which so comparatively little is known by those most interested, namely, foresters and their employers.

This, we trust, will be rectified in future years, when much information of great value to foresters may be gleaned from these reports.

YEW POISONS.—The effect of plants on cattle seems to be different under different circumstances. In Ireland the yew is supposed to be poisonous, and the natives destroy it in the woods to which their cattle have access. Yet you will find it growing in the demesne where cattle have a free run. Ivy and laurels will kill some cattle, while others are yearly fed on them in winter. Wild celery some cattle can eat with safety, while it is a rapid poison to others. It would seem "that some men's meat is other men's poison." Or possibly these different foods would not be injurious if the cattle were used to them.—KINAHAN.

Woods and Woodlands.

LECTURE BY PROF. WILLIAM H. BREWER, CONNECTICUT, U.S.A.

Communicated by Burnet Landreth, Chief of the Bureau of Agriculture, Philadelphia.

(*Continued from page* 620.)

Now in this country we lack all this rich experience, and the great problem must be solved by experiment. What "*field crops*" would be successful here was once a similar matter of experiment, and it was a long time after the settlement of the State before it was proved that spelt, and rape, and lucerne, and sainfoin, and even cotton, were not adapted to New England agriculture; and now we must go through a similar series in regard to *trees*. Long before the American Independence, under the auspices and encouragement of a society formed in the mother country, it was demonstrated that it was useless to plant cloves, and coffee, and cinnamon, and camphor, and similar trees in these colonies; happy would it have been for us if, at the same time, a few thousands of each of the European timber trees had been planted here also, that we might now have their history for our use.

We plant forest trees for two entirely distinct purposes, which we may, for illustration, call the ornamental and the useful. I do not wish to be too particular, however, about these terms, for the ornamental are often eminently useful, and the useful as often are conspicuously ornamental. But where trees are grown primarily for their beauty and their shade, or even as screens, we can afford to put more expense upon their planting and rearing than where their chief value is for timber or wood. For example, how precious are the shade trees held in our cities! many a citizen of New Haven would think a thousand dollars per tree for the magnificent elms before his door a poor compensation for their loss. Nor is such a value confided to city tastes. When I once mentioned this sum to an old farmer in this State, as the value set by a city friend of mine on his trees, the old man quietly answered, "It would take twice that to buy the elm in front of my door."

If we wish to plant trees for ornament or shade, whether in our towns or in our fields, we have a goodly variety to choose from. With us the white elm is perhaps the most popular species; its beauty and the rapidity of its growth are well known. The most of the magnificent elms which have made New Haven famous were planted only about a hundred years ago, and many of them less. Maples are also popular, but the foliage is rather too dense for planting close to houses. The sycamore is a fine tree, but less popular now than formerly. The beech, tulip, horse-chestnut, and in places the willow, are also popular. I cannot but think that the chestnut will some day become more popular than now, and I know of some magnificent specimens of the white ash as an ornamental tree.

In planting for the wood, whether to be used as timber or fuel, other questions come in, and the problem is more complicated. We want to expend less labour, and money, and get profitable results. The hard woods

of Connecticut are eminently valuable. The toughest oaks and hickories of the United States grow on the hills between New Hampshire and Virginia. Farther west the trees grow larger, but the texture is not so firm. Manufacturers of wagons, furniture, and other articles, prefer western-grown lumber where *beauty* is the most important element; finer-looking furniture and finer-looking carriages can be made, and with less cost of the timber which grows west of the Appalachians, it "works" easier; but where either great strength or durability are especially desired, then eastern timber is better.

In this connection it is well to remember that for these last qualities the largest trees are not the best. If any of you wish for any purpose a particularly tough stick of white oak, hickory, or white ash, you will not take the largest trees, but rather one of smaller size, second growth if possible, one that has grown on the right kind of soil and with a sunny exposure. Young trees are the best, and cultivated trees are apt to be the straightest, and of the best form. And while on the subject of kinds, I will say that the white oak is not so beautiful a tree here as farther west. I have never seen such magnificent examples in New England as I have in Western Pennsylvania, West Virginia, and Western New York. But there, as here, the toughest timber is not found in the largest trees.

Regarding planting for use, as I have said, we lack extensive experience here. It is better to transplant young trees than to plant the seeds where the trees are to be grown. With some, as the hickory, transplanting is more difficult; but I have heard men say that it was successful if the tap-root be cut off the year before transplanting. We have more experience in transplanting native species than foreign ones, because we have used them more for ornamental uses, and now it is very desirable that foreign kinds be tried on a larger scale as useful trees, particularly the larch, elm, pine, and willow of Europe. And, by the way, this last tree, the willow—the white willow, I mean—has not been tried in New England as it ought to be. There was in the West a speculative fever about it a few years ago, for use for hedges, which, like all speculative projects of such a kind, led to much disappointment and loss; but in places it was successful, eminently so, particularly so on low lands. A writer in one of our agricultural papers this year speaks of a willow fence-rail which was still sound after twenty-seven years' use in a fence, and of a tree he has, planted thirty-two years ago, and now four and a half feet in diameter. I have often remarked, in my own observation, the rapidity of growth of this species when under favourable conditions. In England, where it is often sixty or seventy feet high in twenty years, there is no wood in greater demand than good willow. It is light, very tough, soft, takes a good finish, will bear more pounding and knocks than any other wood grown there, and hence its use for cricket-bats, for floats to paddle-wheels of steamers, brake-blocks on cars; it is used extensively for turning, planking coasting vessels, furniture, &c. Its bark is used for tanning (willow tan-bark was exhibited at the Centennial Exhibition from various European countries), its sprouts for withes and baskets, its wood for charcoal, in short, it is considered in very many sections of Europe one of their most valued trees, and has been planted from remote times. Here we occasionally see the yellow or golden variety planted for ornament, yet how few of us ever hear of the value of the wood. Two different farmers have told me that it makes the very best ox-yokes; it is used for making wooden legs, and its charcoal is sometimes used for making gunpowder.

It is impossible for me here to speak of all the foreign trees that

might be tried, and of which we have already some experience in planting for ornament. The Scotch fir needs more trial. The larch is now extensively planted in the west, but it remains to be seen if its good qualities abroad will be perpetuated here. The European grown wood is very durable. I have no data relative to its qualities when grown in this State, but Professor Matthews, of the Iowa Agricultural College, who has grown it there for seventeen years, is led to doubt the durability of the wood when grown on the rich western soils. Some authorities say that a certain coldness of climate and poverty of soil are necessary to the production of the timber in perfection. The European elm is considerably used for timber abroad; here it is only planted for ornament: it appears to thrive well. I know some trees in this State apparently a century old, and in and near Boston there are some of large size.

The English oak, so famous for its strength and durability, is in reality two species (*Quercus pedunculata* and *Q. sessiliflora*), both having leaves and wood much like our white oak; but I am inclined to think that the wood is less liable to warp than ours. They are the most valued of English hard woods. Both are extensively cultivated, and attain a height of fifty feet in thirty years, and both may attain a height of a hundred feet in rich soils. They live to a great age; several trees in Great Britain are known to be from 500 to 1,000 years old, and it is also noted for its beauty. The wood is very durable. A chest was shown at the Centennial Exhibition of oak from the timbers of the Salisbury Cathedral, over 600 years old, and still sound as ever. The oaken doors of Westminster Abbey are believed to be over 1,200 years old, and Lindley says that one of the oak coronation chairs in that noted church has been in its present position over 570 years. In the castle of Winchester is "Arthur's Round Table" of oak. Three hundred years ago it was spoken of as being then over 1,000 years old. This timber is usually cut in spring, when it peels easily; late in May or early in June is considered the best season. One reason, however, is that the bark is saved for tanning, and at this time it is easily removed. The recommendation to bark the tree some time *before* felling is English, and has been practised there, and has been recommended by high authority; but American shipbuilders think this practice a positive injury to the timber when performed on American oak.

Please keep in mind the difference between the planting of a few trees for ornament or shade, and the planting of many for useful wood and timber. The first will always be practised; it is already a great success with us, and has been so long practised that, except here and there an isolated patriarch left standing, the planted trees of our older towns and cities are larger than the natural forests. Planting forests for use is, however, an almost untried experiment in this State, so far as I know. There has been of late years an increase in the area of woodlands in some counties, but this has been of spontaneous growth rather than of planted trees, and where cattle and sheep are kept out, such new growth is pretty rapid and, I am told, profitable.

With forestry proper we have no statistics in this country, and almost no experience. In the Western States, particularly those sparsely wooded by nature, there has been much tree-planting, and there is already a considerable experience of a certain sort. In Massachusetts there has been something done, and Professor Sargent, of the Harvard University, is doing a noble work in collecting information, collating facts, devoting much study to the subject, disseminating the useful information, and awakening the public to the importance of the work. The soil, climate, exposure, and native wood is so much like ours, that the experience of that State is of

more use to us than that of the western States. Professor Sargent has given us some of their experience, which I will use here.

Near Lynn, a plantation of about 200 acres was begun in 1846, some 200,000 imported trees being planted in three years, and nearly as many more added later, raised from the seed. This was on poor, stony hill-sides, fully exposed to the wind. Many species were used, but more of the European larch than any other; but oak, ash, maple, Norway spruce, Scotch and Austrian pine were also planted. Professor Sargent says that when he visited the plantation last year, twenty-nine years after the first planting, that of the larches some are over 50 feet high and 15 inches in diameter at three feet from the ground, and that the average of many trees examined is over 40 feet in height and a foot in diameter, and that the broad-leaved trees have made a similarly good growth. The plantation is now very valuable, and the experiment considered successful.

Another experiment is near Wood's Hole, begun in 1853, also on a tract good for little else—a bleak, stony, poor place. This, too, has been successful. Professor Sargent gives the sizes of the trees:—Larches and Scotch pines, 40 feet high, &c. He makes the significant remark that "the foreign species, as was to be expected from the situation, have been most successful." Of this plantation perhaps one-fourth of the trees were imported, or procured in this country and sent out, "but fully three-fourths of the whole plantation was made by sowing the seed directly on the ground where the trees were to stand."

In the newspapers I have seen accounts of pitch pine plantations on Cape Cod, and articles in the Reports of the Agricultural Department at Washington speak of them as successful; a thousand acres of land now covered with thrifty pines from seed sown on "land which but for this protection would have been a waste of drifting sand."

On the island of Nantucket considerable tracts were planted with American pine. This has not been successful so far as getting a thrifty growth is concerned. The ground is covered, but the trees are stunted, at least such portions of the plantations as I visited five years ago. The Boston and Providence Railroad will plant some of their unoccupied land in the spring to grow ties.

Some years ago I understand that the Massachusetts Agricultural Society offered a prize of a thousand dollars for the best ten acres of white oak raised from acorns planted where the trees were to stand. An exposed hill-side was so planted near Newburyport, and the premium paid, as there was no competition. The method was bad, and Professor Sargent writes me that he thinks the success indifferent.

I ought here to say that after a careful consideration of the subject Professor Sargent thinks "the white ash (*Fraxinus Americana*) is the most valuable of all our native trees for this State" (Massachusetts). As I read this I remembered some magnificent large trees of this species I saw in the eastern parts of our own State a few years ago, which had been planted by the street in a little town.

I have already said there had been considerable tree-planting in the west, but while there is much written on the matter their experience is of little immediate value to us, because of the difference of soil, climate, and markets.

Where trees are planted, or, we may say, transplanted, it is possible for them to thrive well, and yet never become naturalized. That has been the case with the Lombardy poplar as an ornamental tree here, and is even more marked with the linden in England, which has been there no one knows how many centuries, is common enough there now, yet it never seeds.

It must be replenished from foreign seeds. Analogous to this class of facts, and perhaps even more curious, a foreign species may thrive well, make a particularly fine growth, and seed abundantly, and yet the second generation, produced from the seeds of the first, not thrive well, so that, instead of the species becoming acclimated, it deteriorates unless the seed is brought from a more favoured region. Thus the Douglas spruce, a most magnificent conifer from Oregon and California, thrives well in England, I may say *very* well. I was told this summer of trees 100 feet high from seed sent from Oregon less than fifty years ago by Douglas, the botanist, from whom it is named; and although there are tens of thousands of thrifty trees of this species in Great Britain from Oregon seed, there are numerous failures where the trees have been started from the seed produced in England.

Facts of this kind have long made me believe that a United States Commissioner of Forestry should be created, a man to collect and disseminate information, that the experience of one region might be valuable to another, in suggestion if in nothing else, that causes of failure in one place might be known and avoided in another; for, remember, the grand experiment is in progress, and there must needs be much indifferent success, and sometimes total failure, before the best way will be known. A forest crop, unlike a field crop, is too long-lived for a man to afford many failures; one great reason why forestry grew up in Europe was because of Government aid, or the holding of large estates in the possession of a family, and results could be waited for; while American farmers usually need quicker returns for capital or labour invested. We had woods and timbers shown at the Philadelphia Exhibition, 600, and one piece was alleged to be of over 900 years' growth; a Government might possibly plant for a crop like that,—an individual never would. Those specimens, however, were of nature's planting.

Now for a few words about the best time for *cutting* timber. I know that this is usually regulated by the convenience of the farmer or woodcutter,—he cuts the timber at the time most convenient to him, regardless of the effect of season on the nature of the wood felled. In winter, swamps are frozen, so that we can get in them to cut, and we could not in summer; and so in other cases we must be governed by other conditions than that of mere quality of the product.

Much has been written as to the best time for cutting timber, in respect to the quality of the wood. In England, Germany, and I think in continental Europe generally, March to May are usually considered the best months. I will not cite special authorities, but will here say that persons who work up "items" for the public press often commit serious errors by not telling *where* a certain rule obtains, and I see frequent "items" in our papers, even those devoted to lumbering, which evidently originated in the old countries, and do not apply here. In a recent U.S. Agricultural Report, Dr. Hartigis cited as an authority as to best time being March and April, and the theoretical reasons are given in the relative amounts of sap that will dry out of timber cut at various ages. I do not know what Dr. Hartig is quoted, but I strongly suspect it to be an eminent German writer of that name on this subject, and that the woods referred to are German trees, grown on German soil and in a German climate,—all a very different thing from our species, grown 4,000 miles away under very different conditions.

I have examined all the American authorities whose writings I have met with for some years, and also made numerous personal inquiries, and nearly all agree that the best time is from June to October inclusive.

Here, too, I will not quote the special authorities, but in the various agricultural papers and other publications there is a considerable amount of testimony to the point, that timber cut in summer, peeled at once, and laid up from the ground to season, is much more durable when used as timber, and spends better as fuel. Mr. L. F. Allen says, "We have numerous examples of timber cut at this period which has exhibited a durability twice or even three times as great as that cut in winter when placed under precisely the same circumstances." This testimony is substantiated by many others. I have collected much testimony either orally or in published statements from this State, New York, New Jersey, Ohio, and Pennsylvania, and it seems to me that the testimony is ample. I am the more particular in dwelling on this because the experience is different from what it is in Europe, judged from the statements of such standard writers as I have consulted.

We greatly lack full and complete experiments and tests on the strength, expansion, and other properties of American timbers, tested under various conditions. There are very many such relating to European woods, but regarding ours they are all incomplete. The papers have had accounts of some recent interesting experiments by Prof. Thurston, of the Stevens Institute of Technology, on the ability of American woods to resist torsion or twisting, but I have not the detailed results.

I will notice hastily another item I have noted down to speak about—that is, the preservation of woods partly in the ground, like posts, and other positions exposed to rot. As before said, posts cut in summer, peeled and well seasoned, are more durable than when cut in the winter—often twice or thrice as durable. Again, posts set with the little end down—that is, inverted from the position in which they grew—will last longer than if set the other way. All the testimony with which I am familiar, of those who have given it a fair trial, agree to this, and some say the durability is sometimes quite as great.

Many preservatives have been recommended, of which I will only speak of some that are most available to our farmers. The simplest of all is charring the surface; sometimes this retards decay, at others not, the time of cutting of the post, and the degree to which it is seasoned before setting, affect the efficacy of the charring. Posts cut in winter sap-rot quicker than those cut in the summer, and when decay once begins it extends, for rot is to a certain extent infectious. When speaking of seasoning timbers, I ought to have spoken of *smoke-seasoning*, a practice old as the days of the ancient Romans, but less common in these days of kiln-drying than formerly. It is undoubted that smoke-dried timber has its durability increased, perhaps by the creosote, which is a very powerful antiseptic. Salt is sometimes used; it is efficacious so long as the salt remains in the stick, but it soon washes out, and the post rots as if it had never been salted. Better than this is sulphate of copper, or blue vitriol. A weak solution of this, in a half-hogshead tub, into which the previously dried posts are set for a few days, greatly increases the durability. Crude kerosene is sometimes used, and crude gas tar. I cannot speak well of the results; sometimes they are successful, at others it has been questioned. The heavy oil obtained in the distillation of coal tar, called in this country "dead oil," but in great Britain "creosote oil," is extensively used for this purpose, and is rather efficacious. Some of these same materials have been used also for fences, shingles, and other structures above ground. Lime-water, lime whitewash, oils, various paints, undoubtedly increase the durability of exposed timbers; anything that keeps out the water, or kills microscopic fungi, which usually accom-

pany rot, will increase the durability of woods. Water and air are the immediate causes of decay; if either be absent, it is probable that wood might be kept indefinitely. I have seen wood of mummy-cases from Egypt, believed to have been used long before the birth of Moses, still sound, because water had not been present to aid in the rot. Again, I have seen wood called fossil, because of its age, buried hundreds of feet beneath the soil, taken from borings; even more, have myself taken wood only partly mineralized from strata called the upper cretaceous, where it must have been very many thousands of years before man came on earth. In these cases there was water enough, but the air was lacking. So it is, that anything and everything not corrosive in itself, which excludes either air or moisture, hinders decay, and the farmer can often make a practical use of the principle.

I will now close with the hope that our old forests will be better cared for, new ones planted, and our present supplies of wood and timber used more economically.

The Use of Dynamite for Forestry Purposes.

A SERIES of very interesting experiments with dynamite took place recently at Hagley Park, near Stourbridge, the seat of Lord Lyttelton. The experiments were conducted by Messrs. Johnson and Co., of Dudley (agents for Nobel's Explosives Co.), in the presence of Lord Lyttelton and other gentlemen. In consequence of the late high wind or gale, several very fine trees had been blown down on this estate, including part of those composing the beech avenue, which is formed of very old and magnificent beech trees. Operations were commenced by blowing to pieces several ash roots in the hedgerows on the farms belonging to the estate. A 1½-inch auger hole having been bored in each of these, they were charged with a few dynamite cartridges, and broken into convenient pieces.

In the park, there were some dozen old roots which had been grubbed up, and lying out of the ground for some time. These were smashed up by placing a small cartridge in a crevice or natural fissure of the roots, thus saving the trouble of boring an auger hole. On the lower side of the park there were some half-dozen very large and tough roots, with the fangs still fast in the ground. A crowbar hole having been made under each side of the root and opposite each other, inclining to the centre underneath the main stump, a few 1-inch cartridges were inserted in each hole, the fuses were cut the same length, and fired together, both shots exploding simultaneously, and blowing the root with its fangs and smaller fibres completely out of its bed, leaving an immense cavity behind. The party then repaired to the Park Avenue, where several monster roots awaited them; one gnarled root, the growth of which was said to be 150 years, and the extreme length and breadth of which covered an area of thirty-two square yards, looked like bidding defiance to auger, explosives, or anything else. Auger holes were out of the question, as it would have taken at least fifty to bore it properly, but fortunately a huge recess was discovered between two of the main ties or fangs, about sixteen inches by eight, leading downwards towards the centre and strongest portion of the root.

This was charged with a case, or five lbs., of dynamite. On the fuse being lighted the visitors retired behind the neighbouring trees to watch the effect. The charge exploded, blowing the whole mass with the root and at least eight or ten tons of earth into the air some dozen feet or so, breaking it into about a score of pieces. A few auger holes, and the job was completed in the short space of forty-five minutes. The remainder of them were similarly treated, with the exception of one which was lying out of the ground within forty yards of the conservatory, which was broken by inserting a *small* cartridge in a *deep* auger hole, thus preventing the slightest injury to the glass. At the conclusion of the experiments Lord Lyttelton said they had given every satisfaction, and were a thorough success. Perhaps it may not be out of place here to give a short account of the history of the powerful explosive, which will doubtless be interesting to some of our readers.

Dynamite is an explosive compound, the constituent parts of which are nitro-glycerine and a silica called "Kieselguhr," which is mostly brought from Germany. Nitro-glycerine was discovered in the year 1846 by Sobrero, but for a considerable number of years was known only as a chemical curiosity. Mr. Alfred Nobel, a Swedish mining engineer, and the subsequent patentee of dynamite, having made it the subject of a number of experiments, discovered a method by which it could be made available for blasting purposes, and patented also a very powerful percussion cap for use with it. Mr. Nobel was first engaged with the manufacture of nitro-glycerine at Hamburg, but he experienced great difficulty in getting the stuff carried, owing to the nature of the compound, and the accidents to which it was liable in shipment and carriage. The great drawback seems to have been in obtaining a proper vessel in which nitro-glycerine (with a specific gravity of 1.6) could be packed and carried across the country with safety, but at last the patentee hit upon the plan which had its issue in the invention of dynamite. He absorbed this highly dangerous liquid (nitro-glycerine) in a soft porous substance to neutralize its explosive properties, and this new compound he called dynamite.* The substance which he chose as the absorbent was "Kieselguhr," immense beds of which may be found at Hamburg. Dynamite is manufactured at Ardeer, in Ayrshire, Scotland, and notwithstanding the immense output, and the large number of workpeople employed in the manufacture of it, there has not been a single accidental explosion since operations were commenced at the works in February, 1873.

FORTHCOMING SALES OF BRITISH TIMBER.

THE *Timber Trades Journal* of March 30th contains the following announcements of timber sales. Following the name of the county is the name and address of the auctioneer, who will in every case forward a catalogue on application :—BERKS.—A. Davis (Newbury), 5th April, at

* The proportion of the two ingredients is seventy-five parts of nitro-glycerine to twenty-five parts of "Kieselguhr," and when the two have been well mixed together the new compound—dynamite—is ready to be shaped into cartridges.

Hamstead Marshall. BRECON.—3rd April, at Brecon. Particulars of Charles Griffiths, estate agent, Hay. BUCKS.—W. P. Gadsden (Aylesbury), 2nd April, Boughton House; Harrison and Son (Buckingham), 11th April, at Tingewick. DERBY.—Warner, Sheppard, and Wade (Leicester), 8th April, at Ockbrook and Hopwell, near Derby. DEVON.—Rendell and Symons (Newton Abbot), 1st April, at Chudleigh; Sawdye and Son (Ashburton), 4th April, at Rattery; Hill and Pryke (Bow), 9th April, at Down St. Mary. DORSET.—G. Symonds (Sydling), 2nd April, at Middlemarsh; Mr. Hannen (Fordingbridge), 10th April, at Cranborne. GLAMORGAN.—Hutchins and Son (Newport, Mon.), 4th April, at Neath. GLOUCESTER.—G. Nicholls (Bristol), 1st April, at Portbury; C. and J. Cadle (Gloucester), 2nd April, at Upton Wood. HANTS.—H. R. Winckworth (Romsey), 3rd April, at Ampfield; E. Eames (Petersfield), 3rd April, at Basingstoke; G. and A. Etherington (Petersfield), 9th April, at Rake; A. White (Basingstoke), 2nd April, at Stratfield Turgiss; 3rd, at Basingstoke; F. Ellen and Son (Andover), 3rd April, at Andover. HERTS.—A. McKenzie (Hoddesdon), 3rd April, at Hoddesdon; Sedgwick and Son (Watford), 3rd April, at Watford; Geo. Jackson (Hitchin), 11th April, on Frythe Estate. KENT.—Bayley and Son (Ashford), 3rd April, at Wye; Mr. Wilks (Mongeham), 10th April, at Swanton Court; Messrs. Cronk (Sevenoaks), 4th April, at Chevening Estate; W. Sharp (Canterbury), 4th April, at Canterbury; H. H. Stickings (Ashford), 8th April, at Stone Street; Minter and Son (Faversham), 12th April, at Frinsted. LANCASTER.—G. Corbishley (Thornham, Lancaster), 2nd April, at Claughton Hall. LINCOLN.—Richardson and Son (Stamford), 8th, 9th, 10th, 11th, 12th, and 16th April; J. T. Tateson (Lincoln), 3rd April, at Langworth; B. Briggs (Horncastle), 4th April, at Hainton. MONTGOMERY.—Morris and Price (Chirbury, Salop), 5th April, at Welshpool. NOTTS.—H. Mellars (Worksop), 4th April, at Worksop. RUTLAND.—Messrs. Royce (Oakham), 17th April, at Lobthorpe, and 18th at Stretton. SOMERSET.—J. Collings (Axbridge), 2nd April, at Loxton Woods. STAFFORD.—Fergyson and Son (Leek), 5th April, at Cheddleton Heath. SURREY.—Drewitt and Son (Guildford) on Clandon Estate. SUSSEX.—C. Hunt (Horsham), 3rd April, at Horsham; H. J. Austen (Wadhurst), 8th April, at Wadhurst. WARWICK.—R. Crisp (Atherstone), 4th April, at Atherstone. YORKS.—W. Walker (Bedale), 24th April, at Swinton Park; Lodge and Bartle (Crossgates), 5th April, at East Rigton.

SALES BY TENDER.—DENBIGH.—Whitewood at Wynnstay. Tenders by 6th April, to J. S. Laycock, Wynnstay office. HEREFORD.—Timber at Yatton Court Estate. Tenders by 10th April to J. G. Rodney Ward, Esq., Yatton Court, Kingsland, Hereford. IRELAND.—Timber at Cuffsborough, Queen's County. Particulars of Mr. Joseph Kelly, Kinclare, Caltra, Ballinasloe, co. Galway. SALOP.—Timber at Norton, near Market Drayton. Tenders before 6th April to T. Cundy and Sons, 7, East Parade, Leeds. SCOTLAND.—Wood on Airlie Estates. Apply to P. M. Geekie, Cortachy, Kirriemuir. YORKS.—Timber in Bitholmes Wood, near Deepcar. Tenders before 3rd April to Mr. Geo. Parkin, timber agent, Wortley, near Sheffield.

Insect Carpenters.—There are several species of what are called "carpenter caterpillars," which eat galleries or tunnels in trees. In this country the most common illustration of this engineering skill amongst those belonging to the moth tribe is that afforded by the caterpillar of the goat moth (*Cossus ligniperda*), which is said to have been a favourite article of diet among the Romans, and which tunnels its way through the willow tree. But it is probably excelled in ingenuity by the caterpillar of one of the rarer sphinx moths, which is known to collectors as the brown hawk (*Ægeria asiliformis*). In the interesting volume on "Insect Architecture," which was published under the superintendence of the Society for the Diffusion of Useful Knowledge, in 1830, the late Mr. James Rennie gives the following account of what he observed with reference to the proceedings of the last-named of these workers in wood. "We observed," he remarks, "above a dozen of them during this summer (1829) in the trunk of a poplar, one side of which had been stripped of its bark. It was this portion of the trunk which all the caterpillars selected for their final retreat, not one having been observed where the tree was covered with bark. The ingenuity of the little architect consisted in scooping its cell almost to the very surface of the wood, leaving only an exterior covering of unbroken wood, as thin as writing-paper. Previously, therefore, to the chrysalis making its way through this feeble barrier, it could not have been suspected that an insect was lodged under the smooth wood. We observed more than one of these in the act of breaking through this covering, within which there is besides a round moveable lid of a sort of brown wax." The great length of time which some of these boring insects may remain embedded in wood has been amusingly illustrated by the celebrated Sir Joseph Banks, and also by other gentlemen, including Mr. Ingpen, who relates in the tenth volume of the "Linnæan Transactions" that the family of a gentleman at Henlow, Bedfordshire, were much terrified at seeing thousands of wasp-like flies (*Sirex duplex*) emerge from holes in the floor, large enough to admit a small pencil-case. The house had been built three years, but long before that time the insect carpenters had been busily at work in the spruce fir trees, from which the builder had obtained his supply of wood; and as in their case "labour and rest unequal periods keep," it was only after this long interval that they were enabled thus suddenly to appear in what is technically known as the imago or perfect state which presents a striking contrast in its well-dressed idleness to the dingy obscurity of its previously busy life of hard work.—*Land and Water.*

How was Anacharis Alsinastrum introduced to Britain?—The introduction of this pestilent weed was attributed, about five-and-thirty years ago, when I was at Cambridge, to the scientific zeal of the Professor of Botany, after whom it was nicknamed *Babingtonia damnabilis*. Whether the story was true or not, nobody then held any other belief, so my old friend got the (dis)-credit of it.—W., *in Land and Water.*

Gigantic Black Birch.—The *Nelson Daily Times* of New Zealand states that "a gigantic black birch tree was felled the other day by a surveyor's party at Staley Creek, near Ahaura. It is stated to have measured 57 feet in circumference at the butt."

More Large Trees.—The biggest tree in California is not in the Yosemite Valley. King's River Valley, in Fresno county, is 5,000 feet above the sea, and its walls, which are about 3,000 feet high, are very precipitous. In this valley a new grove of colossal redwood trees has been discovered. One of them eclipses all that have been discovered on the Pacific coast. Its circumference, as high as a man can reach and pass a tape-line around, is a few inches less than 150 feet.—*Lancaster Farmer, U.S.A.*

Curious Discovery.—A few days ago, while some oak timber which had been grown on the estate of Abercairny, Perthshire, was being sawn up in the shipbuilding yard of Mr. Roney, at Arbroath, the circular saw suddenly came in contact with some hard substance with such violence as to completely tear off its teeth. The machinery was at once stopped and an examination made, when a horseshoe was discovered solidly embedded in the centre of the tree. The tree was not over ten inches in diameter, but the shoe was so completely overgrown that the part nearest the surface was at least two inches deep. The shoe was of the ordinary make, and had one nail still in it. There are many conjectures as to how it came there, but from the fact of a nail being found in it, it is probable the shoe had been found in a field by some thrifty farmer, who nailed it to a tree, so that it might not be trampled out of sight, and that in the course of time, through the growth of the wood, it became completely surrounded. Such is a very common but reprehensible practice, as it incurs great danger to the men sawing the timber.

The Rain Tree.—The "Rain Tree," so called, was made the subject of a brief communication by Mr. Thiselton Dyer at the Linnæan Society, February 7th. It grows at Mogobamba, South America, and promises to excite as much interest amongst residents in hot, dry countries as the supposed antimalarious properties of the "Fever Tree" (*Eucalyptus globulus*) has done amongst the inhabitants of hot, wet ones. From information obtained through Mr. Spruce it seems probable that the "Rain Tree" is *Pithecolobium Saman*, and the so-called "rain" the fluid excreta of *Cicadas*, which feed on the juices of the foliage. Thus other trees might become "rain trees;" and the whole phenomenon therefore appears comparable to the production of honey-dew from the lime by the agency of aphides.—*Gardener's Chronicle.*

Tree Felling.—That trees of great size can now be felled by machinery in a few minutes, instead of the usual period of hours, can hardly create alarm, as it is not probable that any one will be so insane as to have trees cut for the mere pleasure of seeing them fall. The wants of the community must be met by felling trees, but the wants of the community one hundred years hence will also need satisfying, and the chances of that being done effectually depends upon the forethought and judgment displayed by the present generation. There is no present appearance of a timber famine, but if our planting does not more than keep pace with felling, such a famine must come some day. There are no indications of a time when wood can be dispensed with, the paving of our city streets with it does not point in that direction; whilst if one hundred years hence the population of the country is doubled or perhaps trebled, the demand for wood will be enormously increased. We must think not only of trees that are purely ornamental, but also of such as will produce valuable timber.—*Gardener's Chronicle.*

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